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17

VOLUME 1

FINAL FEASIBILITY STUDY REPORT FOR HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA

SEPTEMBER 1992

Prepared for:

U.S. Environmental Protection Agency
Emergency and Remedial Response Branch
Region V
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in association with

Life Systems, Inc.
Environmental Engineering & Remediation, Inc.

FEASIBILITY STUDY REPORT
FOR
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

SEPTEMBER 1992

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HIMCO DUMP SUPERFUND SITE
FEASIBILITY STUDY

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ACRONYMS LIST

APEN	Air Pollution Emission Notice
ARARs	Applicable or Relevant and Appropriate Requirements
ARCS	Alternative Remedial Contracting Strategy
ATSDR	Agency for Toxic Substances and Disease Registry
BACT	Best Available Control Technology
BAT	Best Available Technology
BCT	Best Conventional Pollutant Technology
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLP	Contract Laboratory Program
CWA	Clean Water Act of 1977
COD	Chemical Oxygen Demand
EPA	U.S. Environmental Protection Agency
FIT	U.S. EPA Field Investigation Team
FS	Feasibility Study
GC/MS	Gas Chromatograph/Mass Spectrometer
GRA	General Response Action
HELP	Hydrogeologic Evaluation of Landfill Performance
HI	Hazard Index
HRS	Hazard Ranking System
IAC	Indiana Administrative Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
ISBH	Indiana State Board of Health
LDR	Land Disposal Restriction
LEL	Lower Explosive Limit
LFG	Landfill Gas
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NCP	National Oil and Hazardous Substances Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
POTW	Publicly Owned Treatment Works
PW	Present Worth
R&A	Relevant and Applicable
RACT	Reasonably Available Control Technology

RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act of 1976
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SVOCs	Semi-Volatile Organic Compounds
SWDA	Solid Waste Disposal Act
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxic Contaminant Leaching Procedure
TSD	Treatment, Storage and Disposal
TSDF	Treatment, Storage and Disposal Facility
TSP	Total Suspended Particulates
USDW	Underground Sources of Drinking Water
USGS	U.S. Geological Survey
VOCs	Volatile Organic Compounds
VPAC	Vapor Phase Activated Carbon

EXECUTIVE SUMMARY

SEC Donohue (formerly known as Donohue & Associates, Inc., renamed due to the acquisition that occurred in late 1991) is submitting this Feasibility Study (FS) report for the Himco Dump Superfund Site (Himco site). This FS report is submitted to the U.S. Environmental Protection Agency (EPA) in response to Work Assignment No. 17-5L4J under Region V ARCS Contract No. 68-W8-0093. The purpose of this FS is to develop and evaluate appropriate remedial action alternatives based on technical, environmental, public health, and economic considerations, so that an informed risk management decision can be made by the agency concerning selection of the most appropriate remedy for the Himco site.

Site History and Remedial Investigation

The Himco site is a closed landfill covering approximately 100 acres. The site is located at County Road 10 and the Nappanee Street Extension in Cleveland Township, adjacent to the City of Elkhart, Elkhart County, Indiana. The site was privately operated by Himco Waste Away Service, Inc. from 1960 until September 1976. There was no liner, leachate collection, nor gas recovery system constructed as part of the landfill. An estimated two-thirds of the landfill waste was calcium sulfate from Miles Laboratories. Other wastes accepted at the landfill included demolition/construction debris, household refuse, and industrial and hospital wastes. In 1976, the landfill was closed and covered. The cover consisted of approximately one foot of sand overlying a calcium sulfate layer.

In 1984, a U.S. EPA field investigation team (FIT) conducted a site inspection and Hazard Ranking System (HRS) scoring package for the Himco site. Laboratory analyses of samples from U.S. Geological Survey (USGS) monitoring wells showed that the groundwater downgradient of the site was contaminated with volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. At the time of the site inspections, leachate seeps were observed.

The Himco site was proposed for the NPL in June 1988 and officially designated a final NPL site in February 1990.

In July 1989, under the Alternative Remedial Contract Strategy (ARCS) contract, the U.S. EPA issued a work assignment to SEC Donohue to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Himco site. From October 1990 through February 1991, SEC Donohue conducted a Phase I RI at the site, and in September 1991, a Phase II RI. Activities completed included excavation of test pits, installation of monitoring wells, and collection of soil, landfill gas, surface water, sediment, leachate, and groundwater samples for chemical analysis. During the Phase II investigation, a "hot spot" was identified at the southwest border of the landfill. The area showed high levels of VOC contamination. In a site assessment at the "hot spot" in May 1992, EPA verified a high level of VOC contamination. EPA conducted an emergency removal action beginning on May 22, 1992, which led to identification and removal of 71 55-gallon drums containing various liquids.

Field investigation and analytical testing for the site were summarized in an RI report submitted to EPA in August 1992. The RI analysis showed that the principal threats at the site are posed by leachate, the landfill waste mass, and the contaminated soil in the construction debris area. The landfill leachate was found to be contaminated with VOCs, SVOCs, and inorganic contaminants. However, sampling during the RI revealed very limited or no groundwater contamination outside the boundaries of the landfill.

The Human Health Evaluation

Eighty-seven chemicals detected in the site soil, groundwater, leachate, surface water or sediment were evaluated as to the potential for risk to both current and future populations.

No one currently resides or works on-site, however certain other populations may be exposed to site contaminants. These include trespassers who engage in recreational activities (dirt-bike riding, playing, fishing, walking, etc.), residents who live near the site (to the east, west, south and southeast) and workers in nearby commercial and industrial enterprises (to the southeast). Potential routes of exposure for these current populations, which were quantified in the risk assessment, include: inhaling airborne particulates or volatiles released from the site (downwind residents and dirt-bike riders), ingesting soil while dirt-bike riding, ingesting surface water and sediment while wading or fishing, and dermal contact with surface water while wading. With the exception of one drinking water well southwest of the site (Stoner residence across Highway 10), there is no current use of the aquifer in the vicinity of the site.

Future development of the site could be residential, commercial, agricultural, or recreational. Pathways evaluated for future land uses included both soil pathways (ingestion and inhalation of volatiles or particulates) and groundwater pathways (ingestion, inhalation of volatiles released during indoor uses of groundwater, and dermal). Future residents and workers were evaluated both on the landfill area and south of the landfill. Agricultural workers were evaluated on the landfill area only.

There appears to be no cause for concern for any current uses of the site. All carcinogenic risk estimates are below 1E-4 (one excess cancer per 10,000 persons exposed) and no Hazard Indices exceed 1. These estimates place risks within an acceptable range as established by the National Oil and Hazardous Substances Contingency Plan (NCP).

There is cause for concern for future uses of the site that involve use of the groundwater. If homes were built on the site in the future, use of the groundwater beneath the landfill could result in excess cancer risks in the range of 1E-1 (one in ten). For the same exposure pathways, Hazard Indices range from 500 to 1,000. Chemicals contributing to these risks include arsenic, beryllium, cadmium, chromium, vanadium, alpha-chlordane, polycyclic aromatic hydrocarbons (PAH), and vinyl chloride. Additionally, lead is present in this leachate water at unacceptable levels as predicted by the Uptake Bio Kinetic Model. For the future worker (including the agricultural worker), risks were somewhat less but still outside the acceptable range.

If home or commercial establishments south of the landfill were to use groundwater in this area in the future, the estimated site-related risks associated with groundwater use are within acceptable risk ranges. It appears that although the landfill leachate is contaminated at a level of health concern, this contamination has not impacted groundwater south of the landfill to a level of health and environmental concern. (The Stoner well was sampled in May 1992 and showed no contamination.) If a residence were placed in the area of PAH contamination in the southeastern portion of the site, an estimated excess cancer risk of approximately six in 10,000 (6E-4) was calculated for the soil ingestion pathway.

All other future land uses that do not involve use of groundwater do not appear to pose risk at a level of concern.

Environmental Evaluation

The Himco site is unusual in that conditions on a large area support unique wet and dry prairie plant communities and over 100 native plant species. Site conditions are not likely to sustain wildlife species of concern (the Indiana bat, star-nosed mole, and badger). Although no surface streams drain the site, the St. Joseph River is located two miles to the south and contains a diverse fishery.

Contaminants in the soil where the prairie communities are located are not likely to have adverse effects on resident species of plants and animals. The greatest hazard occurs in the south/southeast area of the site where contamination is higher and more varied. However, this area is highly disturbed and unlikely to support ecologically significant populations.

Remedial Action Objectives

The FS identified the following remedial action objectives for the Himco site:

- Prevent direct contact with landfill contents and contaminated soils in the construction debris area.
- Control groundwater usage in the vicinity of the site.
- Minimize contaminant leaching to groundwater to ensure that groundwater remains unimpacted by the site contaminants.
- Maintain the long-term cap integrity by incorporating a gas collection system and drainage control measures into the landfill body.

Remedial Alternatives

The FS analyzes four remedial action alternatives for the Himco site. Except for Alternative 1, the No Action alternative, the alternatives have three elements in common: groundwater monitoring, institutional controls, and landfill gas collection and treatment. RI data indicate that groundwater has not been impacted to a level of health and environmental concern by the site contaminants. A groundwater monitoring program will be developed to evaluate whether the remedy is effective in meeting the remedial action objectives. Institutional controls are necessary to restrict access to the Himco site for present and future uses and restrict pumping from the aquifer in the site vicinity. The alternatives propose collecting landfill gases by an active gas collection system and treating them by vapor phase carbon adsorption. The quantity and quality of landfill gas will be evaluated as part of the predesign investigations.

Alternative 1, the No Action alternative does not provide for removal, treatment, or containment of the landfill waste mass, leachate, or gas. Therefore, the potential for contaminant releases or exposure to contaminants which affect human and environmental receptors would continue to exist.

Alternative 2 uses a single barrier, solid waste cap to contain the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, along with the common elements of groundwater monitoring, landfill gas collection, and institutional controls. The estimated capital cost is $7,539,000; the estimated annual operation and maintenance (O&M) cost is $210,000; the estimated total present worth cost is $10,429,000. The estimated implementation time is 14 months.

Alternative 3 uses the same elements as Alternative 2, but also includes a leachate collection system for the extraction of leachate in the landfill. The estimated capital cost is $13,628,000; the estimated annual O&M cost is $982,000; the estimated total present worth cost is $27,140,000. The estimated implementation time is 21 months.

Alternative 4 is the same as Alternative 2, except that it uses a composite barrier, solid waste cap instead of a single barrier cap. The estimated capital cost is $8,931,000; the estimated annual O&M cost is $210,000; the estimated total present worth cost is $11,821,000. The estimated implementation time is 15 months.

To determine the most appropriate alternative for the Himco site, the four alternatives were evaluated against each other, using EPA's nine evaluation criteria. Alternative 1, the No Action alternative, does not meet the nine evaluation criteria.

Overall Protection of Human Health and the Environment: Alternatives 2 and 3 in theory eliminate the human risk associated with exposure to landfill wastes and contaminated soil and reduce the potential environmental risk from release of leachate. Alternative 4 provides an added level of protection, relative to Alternative 2, by minimizing infiltration into the landfill. Similarly, Alternative 3 provides an added level of protection, relative to Alternative 2, with the extraction and off-site treatment and disposal of leachate.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs): All alternatives, except Alternative 1, meet federal and state ARARs.

Long-Term Effectiveness and Permanence: The single barrier, solid waste cap of Alternatives 2 and 3, and the composite barrier cap of Alternative 4, provide long-term effectiveness and permanence by containing the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, and by implementing institutional controls. All three alternatives reduce potential environmental risk to the aquifer by minimizing leachate generation in the landfill mass. Groundwater monitoring in the three alternatives will monitor the aquifer's condition for a 30-year period.

Reduction of Toxicity, Mobility, or Volume Through Treatment: Alternatives 2, 3, and 4 do not reduce toxicity or volume except for a slight reduction in VOCs through the landfill gas collection. Alternative 3 reduces toxicity and volume somewhat more through leachate collection. Alternatives 2, 3, and 4 all reduce contaminant mobility by reducing leachate generation.

Short-Term Effectiveness: Alternatives 2, 3, and 4 require measures to minimize the short-term impacts on human health and the environment during construction and implementation phases, such as dust control and safe work practices.

Implementability: Technically, all the alternatives are implementable and can be constructed readily with technology and materials presently available. Design requirements for the single barrier cap in Alternatives 2 and 3 are somewhat easier than for the composite cap of Alternative 4. Operation of Alternatives 2 and 4 is somewhat easier than for Alternative 3, which adds a leachate collection and storage system, and requires periodic disposal of leachate at an off-site TSDF.

Cost: Costs of Alternatives 2, 3, and 4 are compared in terms of capital cost, annual operating cost, and present worth cost.

State Acceptance and Community Acceptance: The FS does not evaluate these criteria, since they are to be assessed after the EPA receives comments on the FS and Proposed Plan.

1.0 INTRODUCTION

1.1 PURPOSE AND ORGANIZATION OF REPORT

1.1.1 Purpose

This report presents the results of the Feasibility Study (FS) completed for the Himco Dump Superfund Site (Himco site) in Elkhart, Indiana. SEC Donohue Inc. (SEC Donohue), prepared this report for the U.S. Environmental Protection Agency (EPA) under Work Assignment No. 17-5L4J as part of SEC Donohue's Region V ARCS Contract No. 68-W8-0093. The report was prepared in conformance with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and its governing regulations, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR Part 300.

Field investigation, analytical testing, and a baseline risk assessment and ecological assessment for the Himco site were summarized in the Remedial Investigation (RI) report submitted to EPA in August 1992. The primary objectives of the Himco site RI were to determine the nature and extent of contamination at the Himco site and to gather data necessary to conduct a baseline risk assessment and feasibility study.

The purpose of the FS is to develop and evaluate appropriate remedial action alternatives based on technical, environmental, public health, and economic considerations, so that an informed risk management decision can be made by the agency concerning selection of the most appropriate remedy for this site. The scope of work for this FS is described in the Final Work Plan, dated July 1990, prepared for EPA by SEC Donohue and approved by EPA. The Work Plan describes the tasks to be performed during the FS.

1.1.2 FS Report Overview

The FS includes an initial screening of technologies applicable to site remediation, the development of effective remedial alternatives based on this screening, and a detailed evaluation of these alternatives based on their cost and effectiveness in protecting public health, welfare, and the environment. The FS also presents the analysis involved in developing alternatives that provide a remedial program which is environmentally sound, implementable, performance-oriented, and cost-effective, and results in adequate protection of public health and the environment. The FS proceeds in three phases: the identification and screening of technologies; the formulation and screening of alternatives; and the detailed analysis of alternatives. Figure 1-1 presents the FS report flow diagram.

FIGURE 1-1
FS REPORT FLOW DIAGRAM
Himco Dump Superfund Site
Elkhart, Indiana
1992

EXECUTIVE SUMMARY

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CHAPTER 1

INTRODUCTION

- Review Site History
- Review Nature and Extent of Contamination
- Summarize Baseline Risk Assessment
- Summarize Site Remediation Approach

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CHAPTER 2

REMEDIAL TECHNOLOGY DEVELOPMENT AND SCREENING

- Identify Goals Consistent with NCP
- Identify Remedial Action Objectives
- Identify Applicable or Relevant and Appropriate Requirements
- Identify General Response Actions
- Identify Applicable Remedial Technologies from the list of technologies for municipal landfills developed by EPA (U.S. EPA, 1991)
- Screen Process Options on Effectiveness, Implementability, and Relative Cost

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CHAPTER 3

DEVELOPMENT AND DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

- Assemble Remedial Action Alternatives

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CHAPTER 4

DETAILED ANALYSIS AND EVALUATION OF ALTERNATIVES

Mac/Himco/Tech Figs/073192/1-1

This report is organized into four chapters. Chapter 1.0 summarizes the purpose of the investigation and organization of the report and presents a brief summary of the site history, site background, nature and extent of contamination, fate and transport mechanisms, the baseline risk assessment, and the general remediation evaluation approach for the Himco site. Chapter 2.0 presents the identification and screening of applicable technologies and process options based on technical feasibility and then on cost, effectiveness, and implementability. Chapter 3.0 assembles the retained technologies into alternatives. Chapter 4.0 analyzes and compares the remaining alternatives in detail. Appendices are included as part of this report to present the results of specific technical evaluation upon which the formulation and evaluation of the various technologies and alternatives are based.

The evaluation criteria established in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988a) is the basis for the detailed evaluation. These evaluation criteria consist of the following:

Threshold Criteria

- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Overall protection of human health and the environment

Balancing Criteria

- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

1.2 SITE BACKGROUND

1.2.1 Site Description

The Himco site is a closed landfill located at County Road 10 and the Nappanee Street Extension in Cleveland Township, adjacent to the City of Elkhart, Elkhart County, Indiana. The site is located approximately two miles north of the St. Joseph River which runs east-west through the City of Elkhart. The site covers approximately 100 acres in the northeast quarter of Section 36, Township 38 North, Range 4 East, in Cleveland Township (Figure 1-2). The site is bounded on the north by a tree line and the northernmost extent of the gravel pit pond; on the west by two ponds, the L pond and the small pond; on the south by County Road 10 and private residences; and on the east by Nappanee Street Extension (Figure 1-3). The site is not fenced. In the vicinity of the site are agricultural, residential, and light industrial land uses. There is an access road which leads from the southeast corner of the site near the intersection of County Road 10 and Nappanee Street Extension. A locked gate is present across this road. However, vehicles can easily drive around the gate and enter the site.

The highest elevation on the site is 774.5 feet above mean sea level (MSL). This high point is located on top of the mounded landfill area of the site. The typical ground surface elevation surrounding the mounded landfill area is approximately 762 feet above MSL. The landfill area of the site is covered with a layer of sand of varying thickness. Beneath the sand, a layer of white powdery calcium sulfate, also of varying thickness, is present. The western half of the landfill cover is vegetated with grasses. The eastern half of the landfill cover is vegetated with grasses, bushes, and young trees. Numerous piles of concrete and asphalt waste material are present across the eastern half of the landfill.

There is an abandoned gravel pit operation in the northeast corner of the site. An old truck scale and concrete structures are also present in this area. The gravel pit itself is filled with water which is approximately 30 feet deep. Two other smaller and shallower ponds, commonly referred to as the L pond and the small pond, exist on the west side of the site.

The area south of the landfill and north of County Road 10 is densely vegetated in places. Numerous small piles of rubble, concrete, asphalt, and metal debris are scattered throughout the area. Calcium sulfate is not present in this area.

Eleven EPA monitoring wells and approximately 16 United States Geologic Survey (USGS) monitoring wells have been installed on or immediately adjacent to the Himco site.

1.2.2 Site History

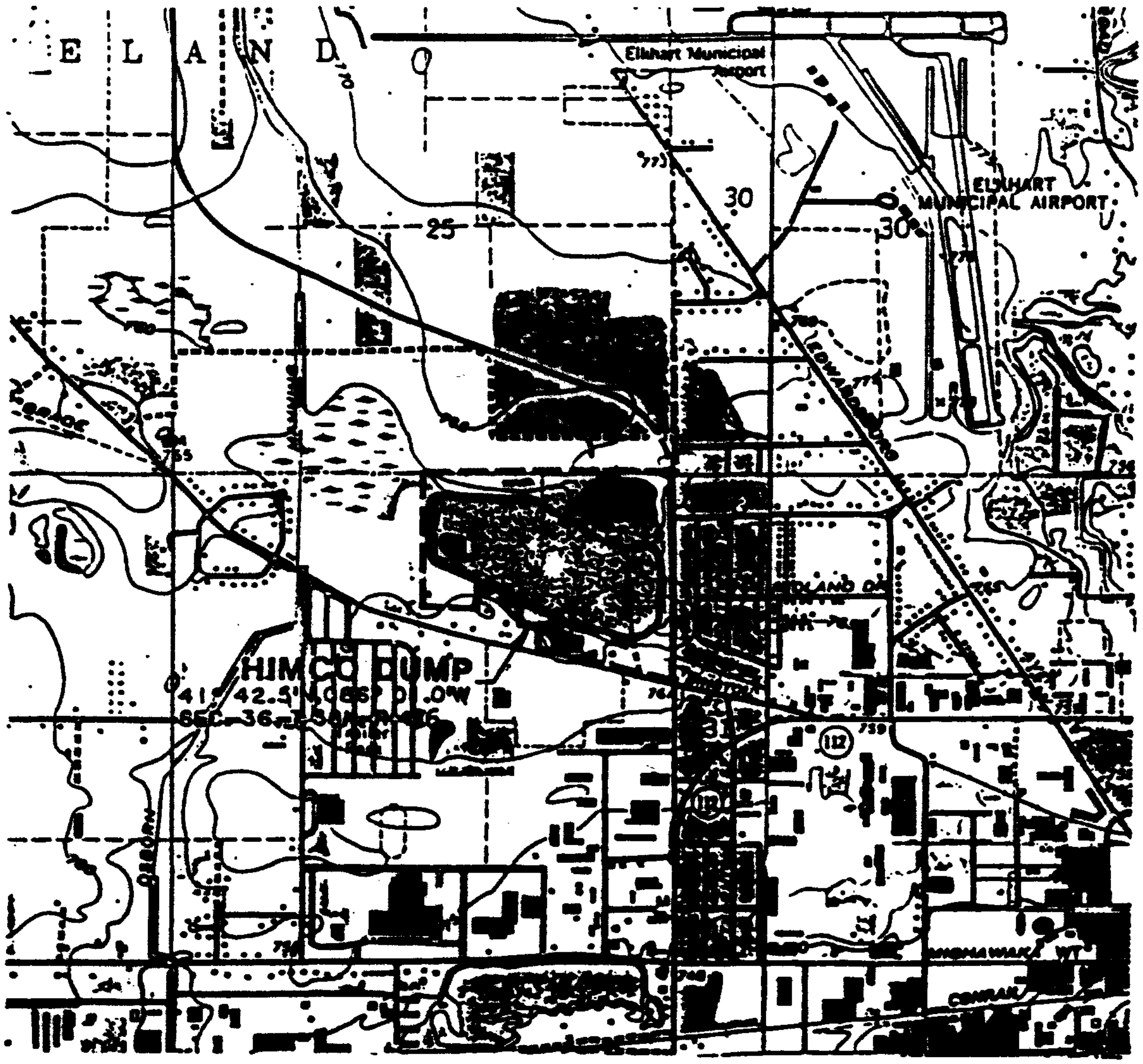
The Himco site was privately operated by Himco Waste Away Service, Inc., and was in operation between 1960 and September 1976. As of January 1990, the parcels of land which comprise the landfill are owned by the following individuals or corporations:

1. Miles Laboratories
2. CLD Corporation
3. Alonzo Craft, Jr.
4. Indiana and Michigan Electric Company

A brief history of the Himco site was provided by Chuck Himes, principal landfill operator, during an SEC Donohue site visit on November 9, 1989. According to Mr. Himes, the area was initially a marsh and grassland. There was no liner, no leachate collection, nor gas recovery system constructed as part of the landfill. Refuse was placed at ground surface across the site, with the exception of trench filling in the eastern area of the site. At that location, a total of five trenches 10 to 15 feet deep, the width of a truck and 30 feet long, were excavated. Paper refuse was reportedly dumped in the trenches and burned. The landfill had no borrow source but obtained sandy soil for daily cover from the gravel pit to the north, the L pond to the west, and essentially anywhere around the perimeter of the site where sand was available. Mr. Himes reported that about two-thirds of the waste in the landfill was calcium sulfate from Miles Laboratories. As much as 360 tons/day were dumped over an unspecified time period. Other wastes accepted at the landfill included demolition/construction debris, household refuse, and industrial and hospital wastes.

In 1971, the Indiana State Board of Health (ISBH) first identified the Himco site as an open dump. In early 1974, residents along County Road 10 south of the Himco site complained to ISBH about color, taste, and odor problems with their shallow wells. Analyses of six shallow wells along County Road 10 by the state showed high levels of manganese. These wells were finished at depths ranging from 20 to 30 feet. Mr. Himes, the principal landfill operator, was advised by ISBH to replace these six shallow residential wells. The new wells were finished at depths ranging from 152 to 172 feet below ground surface.

In 1975, Mr. Himes signed a consent agreement with the ISBH Stream Pollution Control Board to close the dump by September 1976. In 1976, the landfill was closed and covered. The cover consisted of approximately one foot of sand overlying a calcium sulfate layer.



QUADRANGLE LOCATION

0 1000 2000

SCALE: FT.

SOURCE: USGS 7.5 MIN. QUAD ELKHART, INDIANA, 1961
PHOTOREVISED 1981

Donohue

20026

MARCH, 1992

Engineers • Architects • Scientists

SITE LOCATION MAP

HIMCO DUMP SITE
ELKHART COUNTY, INDIANA

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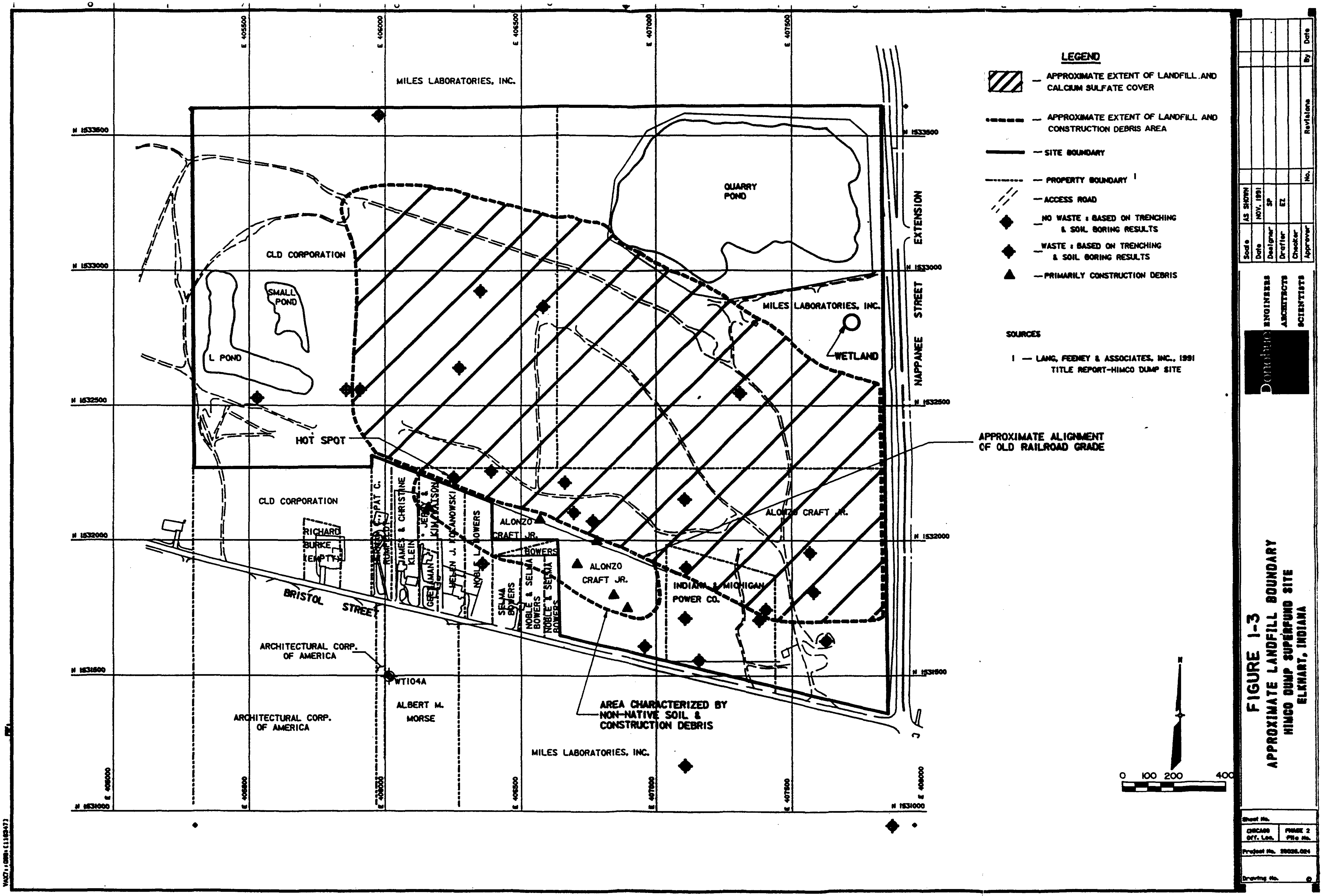
FIGURE 1-2



LEGEND
APPROXIMATE EXTENT OF LANDFILL AND CALCIUM SULFATE COVER
APPROXIMATE EXTENT OF LANDFILL AND CONSTRUCTION DEBRIS AREA
SITE BOUNDARY
PROPERTY BOUNDARY 1
ACCESS ROAD
NO WASTE : BASED ON TRENCHING & SOIL BORING RESULTS
WASTE : BASED ON TRENCHING & SOIL BORING RESULTS
PRIMARILY CONSTRUCTION DEBRIS
SOURCES
1 — LANG, FEENEY & ASSOCIATES, INC., 1991 TITLE REPORT-HIMCO DUMP SITE
MILES LABORATORIES, INC.
QUARRY POND
CLD CORPORATION
SMALL POND
L POND
WETLAND
HOT SPOT
NAPPANEE STREET EXTENSION
APPROXIMATE ALIGNMENT OF OLD RAILROAD GRADE
ALONZO CRAFT JR.
INDIANA & MICHIGAN POWER CO.
RICHARD BURKE (EMPTY)
JAMES & CHRISTINE KLEIN
JERRY & KINTZELSON
HELEN J. KOZANOWSKI
NOBLE BOWERS
BOWERS
SELMA BOWERS
NOBLE & SELMA BOWERS
GREENMAN
BRISTOL STREET
ARCHITECTURAL CORP. OF AMERICA
WT104A
ALBERT M. MORSE
AREA CHARACTERIZED BY NON-NATIVE SOIL & CONSTRUCTION DEBRIS
N 1533500
N 1533000
N 1532500
N 1532000
N 1531500
N 1531000
E 405500
E 406000
E 406500
E 407000
E 407500
E 408000
0 100 200 400
Scale AS SHOWN
Date NOV. 1991
Designer SP
Drafter EZ
Checker
Approver
No. Revisions By Date
Donohue ENGINEERS ARCHITECTS SCIENTISTS
FIGURE 1-3
APPROXIMATE LANDFILL BOUNDARY
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
Sheet No.
CHICAGO Off. Loc.
PHASE 2 File No.
Project No. 20036.024
Drawing No.

In 1984, EPA field investigation team (FIT), as part of the Hazard Ranking System (HRS) scoring package, conducted a site inspection at the Himco site (EPA, 1984). Laboratory analyses from a number of the existing USGS monitoring wells showed that the groundwater downgradient of the site was contaminated by volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and metals. At the time of the FIT site inspection, leachate seeps were observed.

In June 1988, the Himco site was proposed for the National Priorities List (NPL) and in February 1990, was officially designated an NPL site (EPA, 1990).

In July 1989, under the Alternative Remedial Contract Strategy (ARCS) contract, EPA issued a work assignment to SEC Donohue to conduct a RI/FS at the Himco site. From October 1990 through February 1991, SEC Donohue conducted a Phase I RI at the site. Activities completed included excavation of test pits, installation of monitoring wells, and collection of soil, landfill gas, surface water, sediment, and groundwater samples for chemical analysis.

In August 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluated samples from private wells south of the landfill and concluded that concentrations of sodium represent a chronic health threat to the affected residents. At EPA's request, the Potentially Responsible Parties financed the cost of connecting the affected homes to the municipal water supply. By November 1990, municipal water service was provided to the residents.

In September 1991, SEC Donohue conducted a Phase II RI at the site. Activities completed included excavation of test pits, installation of a monitoring well, and collection of soil, surface water, sediment, leachate, and groundwater samples for chemical analysis.

During the Phase II investigation, SEC Donohue identified a "hot spot" at an area at the southwest border of the landfill. A leachate sample from this area contained approximately 50 percent by weight toluene and other VOCs. EPA conducted a site assessment at the identified "hot spot" area in May 1992 and verified a high level of VOCs contamination in this area. In response to this finding, EPA conducted an emergency removal action on May 22, 1992, which led to the identification and removal from this area of 71 55-gallon drums containing various liquids.

1.2.3 Remedial Investigation Results

The RI at the Himco site was conducted to determine the nature, extent, and sources of contamination to support a human health risk assessment, ecological assessment, and to conduct a FS. Media sampled and analyzed during the RI included:

- Surface soil on the landfill cover
- Surface soil in areas adjacent to the landfill
- Subsurface soils adjacent to the landfill
- Waste mass gas under the landfill cover (three feet deep)
- Groundwater
- Leachate collected from within the landfill
- Surface water and sediment from three surface-water bodies (quarry pond, L-pond, and small pond) at the site

Activities completed during the RI also included characterization of the waste in the landfill, identification of the geologic and hydrogeologic conditions, and an assessment of human and ecological impacts.

1.2.3.1 Landfill Characteristics

Figure 1-3 shows the landfill boundaries. The extent of the landfill was determined using a combination of geophysical surveys, test-pit and soil-boring observation, and examination of aerial photographs.

Test pit excavations in the landfill revealed the presence of an inhomogenous waste matrix. In addition, leachate was observed in the majority of trenches excavated, all at elevations above the groundwater table. Leachate was gray-black in color with "rainbow sheens," except at one location near the southwest corner of the landfill. The leachate collected at this location was red and brown and separated into two phases. The floating phase of the leachate contained approximately 48 percent toluene by weight. This location has been referenced as the "hot spot" in the landfill. The hot spot location is indicated on Figure 1-3.

Generally, three fill layers were observed consistently in the landfill. The top layer can be characterized as a silty, sand cover, soil fill which ranged in thickness from a thin veneer to several feet. Underlying the sand cover, and in some cases at ground surface, calcium sulfate was found. It varied in thickness from a few inches to as much as nine feet at the southeastern, central, and southern areas of the landfill. The areal extent of the calcium sulfate layer is shown in Figure 1-3. Beneath the calcium sulfate layer, an estimated 15- to 20-foot thick waste layer was found. This waste layer was found to include paper, plastic, rubber, wood, glass, metal (including drums), as well as small amounts of hospital wastes (e.g., syringes, vials).

Non-native soil mixed with construction debris was observed in test pits outside the landfill area along the south central and southwest edge of the landfill. This area is identified in Figure 1-3. No calcium sulfate was found in this area. SVOC contamination was found to be most prominent in surface soil samples collected from this area.

1.2.3.2 Geology/Hydrogeology

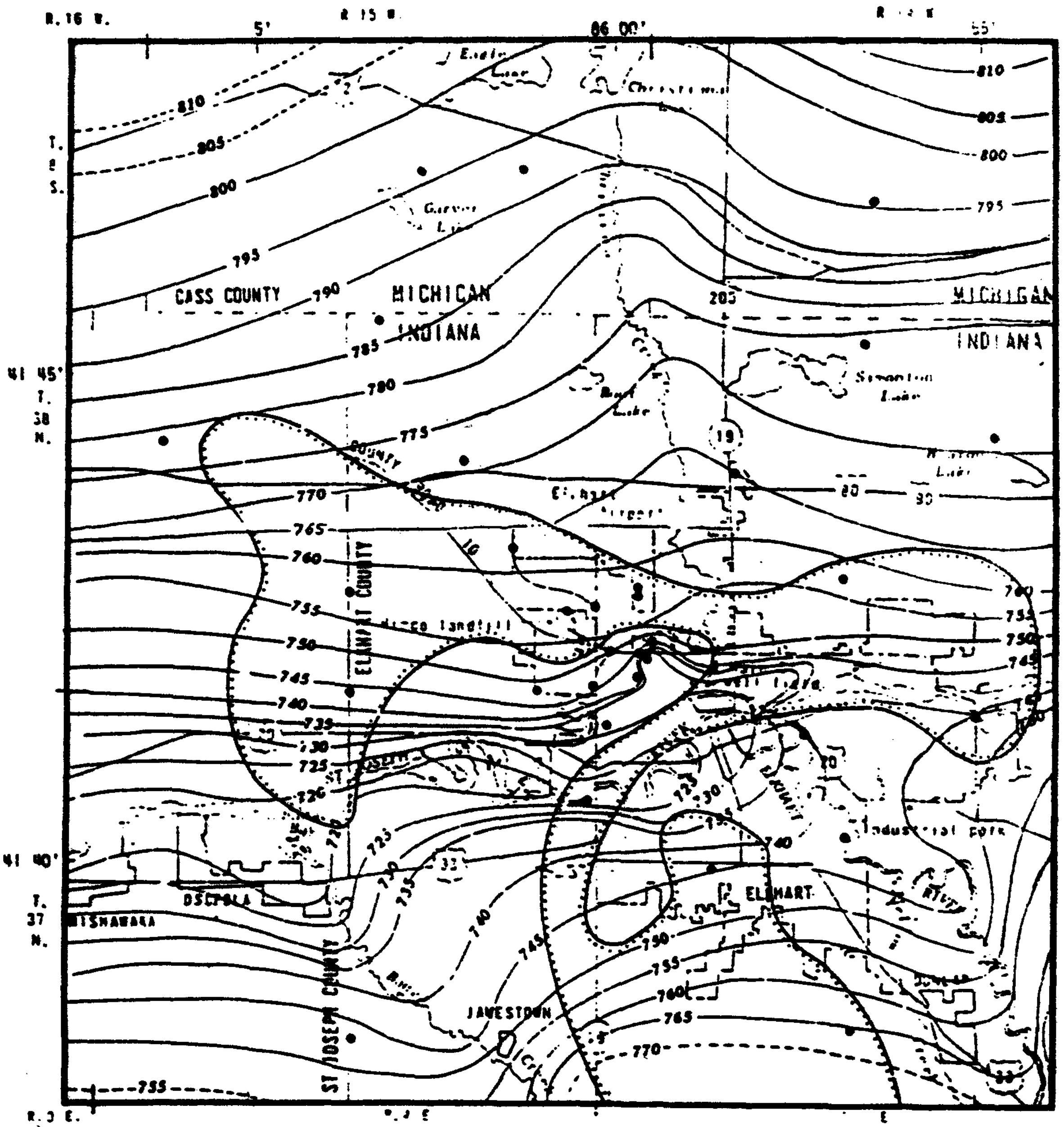
The stratigraphy beneath the Himco site was characterized during the RI as sand and gravel outwash deposits comprised of alternating beds, varying in thickness, of poorly- to well-graded sands and gravels, and gravel-sand-silt mixtures ranging in thickness from approximately 200 to 500 feet below ground surface. These outwash deposits constitute the primary groundwater aquifer at the site. Minor seams of silt and clay were also encountered, but there was no indication of a consistent confining layer beneath the site.

Groundwater occurs between approximately 5 and 20 feet below the ground surface at the site, at an elevation ranging from 752 to 756 feet (MSL) (Figure 1-4). The elevation of the bottom of the waste mass is estimated to range from 755 to 760 feet (MSL). Three surface water bodies representing the surface expression of the water table exist at this site. Groundwater flow is generally to the south-southeast towards the St. Joseph River, which is a regional groundwater discharge for this area. Groundwater recharge is from under flow from the north and from surface water infiltration. The average horizontal flow gradient beneath the site is approximately 0.0016 ft/ft. Vertical gradients are predominantly upward and range from 0.00021 ft/ft to 0.0013 ft/ft. Calculated field hydraulic conductivities range from 0.12 cm/s to 0.00079 cm/s, with an average value of 0.0022 cm/s.

1.2.3.3 Site Contamination Condition

Groundwater

Two rounds of groundwater sampling, RI Phase I and RI Phase II, were conducted during the RI. These two rounds of groundwater sampling revealed very limited groundwater contamination outside the boundaries of the landfill. In general, trace amounts of VOCs and SVOCS were detected in the groundwater samples (Figure 1-5). During RI Phase I sampling, trichloroethene exceeded its maximum contaminant level (MCL) of 5 ug/l in two USGS wells J1 and J2, which are located approximately 2000 feet off-site and side gradient of the Himco site (Figure 1-6). (J1 and J2 are designated as WTJ in Figure 1-6 and are 42 feet and 17 feet deep, respectively.) 1,1,1-trichloroethane (MCL of 200 ug/l) was detected in well J1 at 42 ug/l and in well J2 at 18 ug/l. Table 1-1 presents the range of concentrations for organic contaminants detected as part of the RI.



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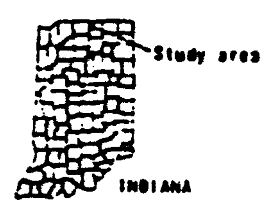

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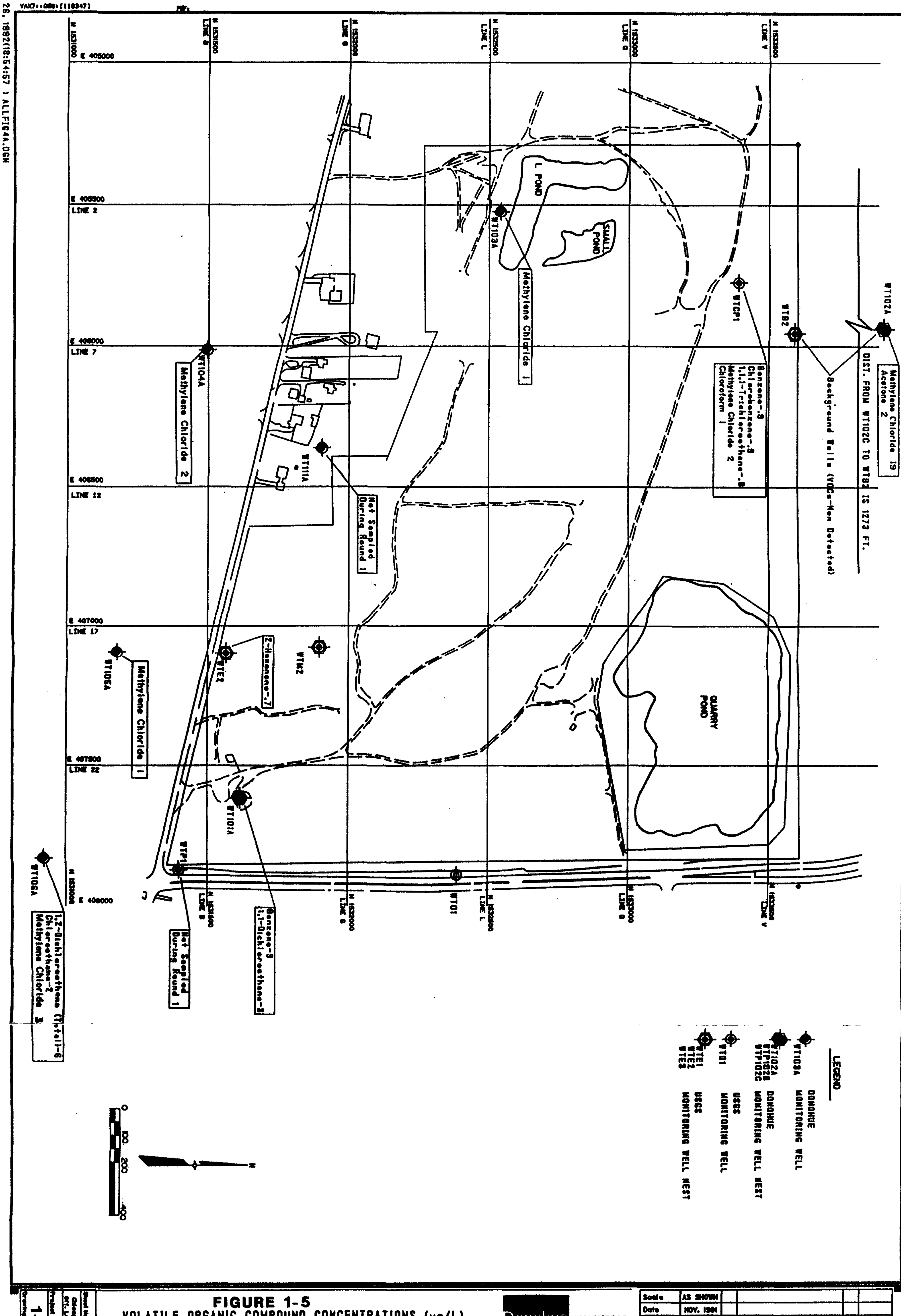
CONTOUR MAP OF UNCONFINED AQUIFER

HIMCO DUMP SITE
ELKHART COUNTY, INDIANA

N

FIGURE I-4



Apr. 26, 1992(18:54:57) ALLFIG4A.DGN

FIGURE 1-5

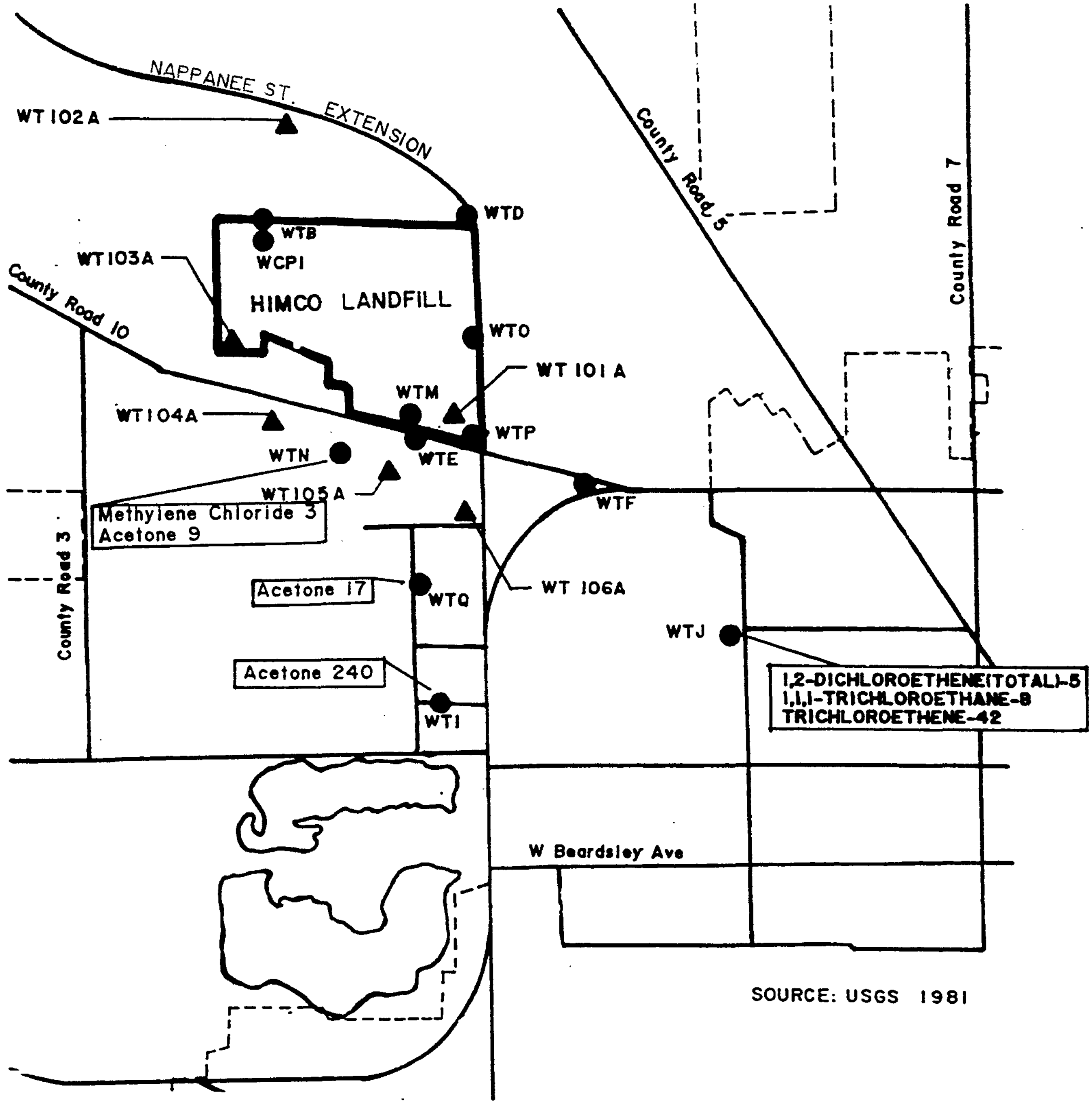
VOLATILE ORGANIC COMPOUND CONCENTRATIONS (ug/L)
DETECTED IN SHALLOW USEPA & USGS WELLS SAMPLED-ROUND 1
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

Donohue ENGINEERS ARCHITECTS SCIENTISTS

Scale	AS SHOWN
Date	NOV. 1991
Designer	SP
Drafter	EZ
Checker	
Approver	

No.	Revisions	By	Date

Drawing No. 1-5



LEGEND

▲ EPA MONITORING WELL

● USGS WELL

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VOLATILE ORGANIC CONCENTRATIONS(µg/l)
DETECTED IN SHALLOW OFF-SITE USGS
WELLS-ROUND I

HIMCO DUMP SITE

ELKHART, INDIANA

N

FIGURE I-6

TABLE 1-1

SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN SHALLOW EPA AND USGS WELLS HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Compound	MCL (ug/l)	Range of Concentrations Detected (ug/l) Round 1	Round 2	Trip Blanks (ug/l) Round 1	Round 2
Acetone	-	9(J)-240(E)	ND	53	8
Benzene	5	0.9(J)-3	1(J)-3(J)	.02	ND
Chlorobenzene	-	0.9(J)	ND	2(J)	ND
Chloroethane	-	2(J)	ND	ND	ND
Chloroform	-	1(J)	2(J)-6(J)	2(J)	1
1,1-Dichloroethane	-	3(J)	3(J)	ND	ND
1,2-Dichloroethene (total)	-	5(J)-6(J)	5(J)	ND	ND
2-Hexanone	-	0.7(J)	ND	ND	ND
Methylene Chloride	-	1(BJ)-19(J)	ND	24	ND
1,1,1-Trichloroethane	200	0.8(J)-8	ND	ND	ND
Trichloroethene	5	2J-42	ND	ND	ND

Qualifiers

ND - Below detection limits
J - Indicates an estimated value
E - Identifies compounds whose concentrations exceeded the calibration range of the GC/MS instrument for that specific analysis
B - Compound was found in the associated blank as well as in the sample
MCL - Maximum Contaminant Level

A/R/HIMCO/AS6

Arsenic, beryllium, and antimony were detected primarily in wells near the southeast corner of the site (Figures 1-7, 1-8). Table 1-2 presents the range of inorganic contamination detected as a part of the RI. The highest concentrations of inorganics were detected consistently in shallow wells. Overall, inorganic analytes detected in filtered samples were similar in concentrations to unfiltered samples, except for Phase I concentrations in USGS well E2, located near the southeast corner of the site. For USGS well E2, the majority of filtered metal concentrations were orders of magnitude lower than unfiltered samples. For example, lead and arsenic were detected in the unfiltered sample at 106 ug/l and 54.5 ug/l, respectively. In the filtered sample, lead was detected at 2.1 ug/l, and arsenic was not detected. In addition, the total suspended solid concentration detected in well E2 was 378 mg/l. Therefore, contamination in well E2 appears to be associated with suspended solids. In addition, the majority of the highest concentrations of inorganic analytes were detected in well E2. Total lead detected in eight wells (e.g., wells B4, E2, and G1 in Phase I sampling and wells B2, E2, M2, P01, WT103A, and WT106A in Phase II sampling) was above the MCL of 15 ug/l for lead. Concentrations ranged from 28.1 ug/l to 210 ug/l. However, filtered lead concentrations on these same wells were not detected or were below the MCLs. Lead concentrations in these wells may be associated with high levels of suspended solid found in these wells.

<u>Leachate</u>

Leachate was sampled at four locations and analyzed for VOCs, SVOCs, pesticide/polychlorinated biphenyls (PCBs), metals/cyanide, and several water quality parameters (e.g., alkalinity, bromide, chemical oxygen demand (COD), chloride). A summary list of contaminants detected in leachate is provided in Tables 1-3, 1-4, 1-5, and 1-6. Leachate from test pit TL5 separated into two distinct phases. Each phase was analyzed separately for VOCs and SVOCs. All other analyses on TL5 were done with the two phases mixed. The other three leachate samples were single-phase samples, and were described as gray-black water with some visible sheening.

Concentrations of VOC and inorganic contaminants detected in leachate were typically orders of magnitude higher than groundwater concentrations. In addition, some VOCs and SVOCs which were detected in the leachate were not detected in the groundwater. VOCs detected in groundwater samples and not detected in leachate samples included bromodichloromethane, chlorobenzene, and dibromochloromethane. None of these three compounds exceeded 2.0 ug/l in groundwater samples. The highest concentrations of VOCs were detected in leachate from TL5. Also, the VOCs detected in TL5 were different between the two phases. Traces of pesticides were detected in leachate samples from TL1 and TL2. Pesticides were not detected in any of the groundwater samples collected.

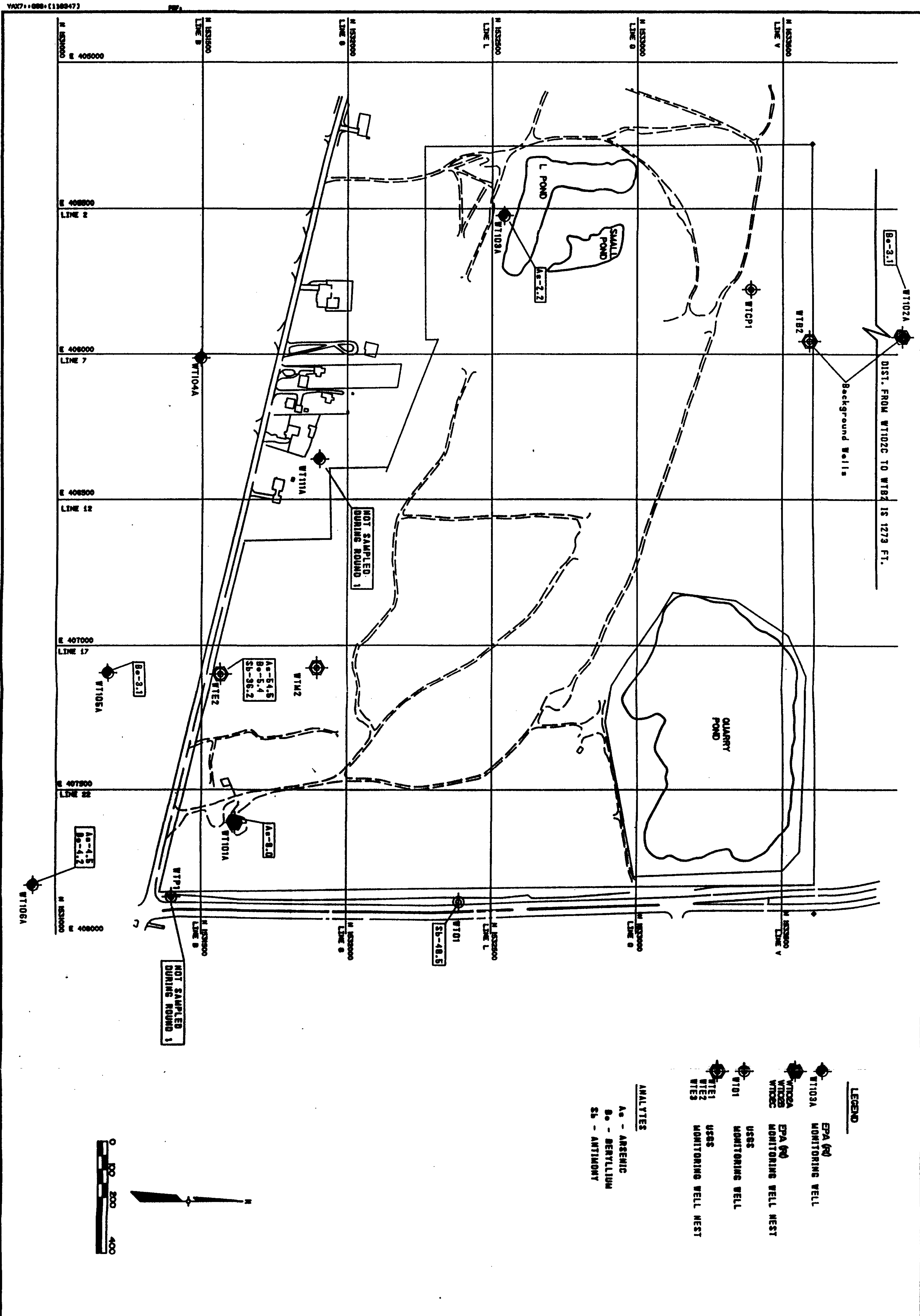


FIGURE 1-7

ARSENIC, BERYLLIUM & ANTIMONY CONCENTRATIONS (ug/L)
DETECTED IN SHALLOW USEPA & USGS WELLS SAMPLED-ROUND 1

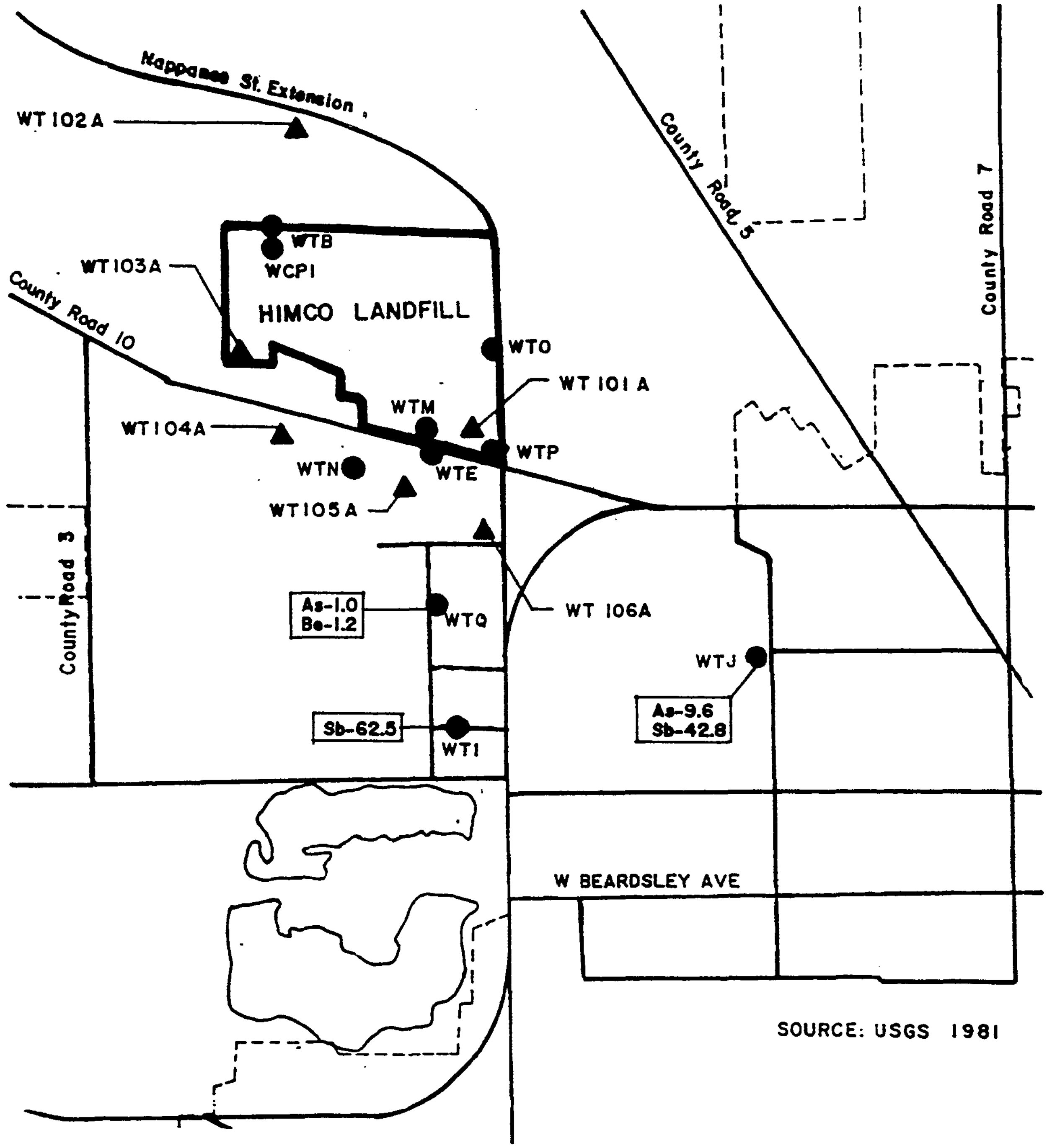
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

Donohue ENGINEERS ARCHITECTS SCIENTISTS

Scale	AS SHOWN
Date	NOV. 1991
Designer	SP
Drafter	EZ
Checker	
Approver	

No.	Revisions	By	Date

Drawing No. 1-7



LEGEND

▲ EPA MONITORING WELL

● USGS WELL

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ARSENIC, BERYLLIUM, AND ANTIMONY CONCENTRATIONS(μg/l) DETECTED IN SHALLOW OFF-SITE USGS WELLS-ROUND I

HIMCO DUMP SITE

ELKHART, INDIANA

N

FIGURE I-8

TABLE 1-2

SUMMARY OF DETECTED INORGANIC ANALYTES (TOTAL)
SHALLOW GROUNDWATER USEPA AND USGS WELLS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

		Background Concentration Range (ug/l)		Range of Concentrations in Downgradient Wells (ug/l)	
Compound	**MCL (ug/l)**	**Round 1**	**Round 2**	**Round 1**	**Round 2**
Aluminum	-	695-81.8	166(BJ)-6,930	23.6(B)-113,000	771.(BJ)-3,130
Antimony	-	ND	ND (BJ)	31.2(B)-62.5	ND
Arsenic	-	ND	5.3(BJ)	1.0(B)-54.5	2.7(B)-24.2
Barium	2,000	22.5-65.5	56.5(B)-125(B)	6.4(B)-510	8.2(B)-218
Beryllium	-	3.1	ND	1.2(B)-5.4	1.3
Cadmium	5	ND	ND	ND	1.3-3.0(BJ)
Calcium	-	77,700-211,000	138,000-165,000	14,100-217,000	15,300-361,000
Chromium	100	6.5-20.9	2.8-24.6	4.3(BJ)-354	2.2-45.3
Cobalt	-	ND	25.4	5.4(B)-28.6(B)	3.1-11.4
Copper	-	87-16.7	31.0	3.7(B)-139	16.6-79.8
Iron	-	123-1,240	60.8(B)-17,200	56.5(BJ)-39,300	29.4-78,500
Lead	15	2.2*	91.2*	1.1(BJ)-106(J)*	6.8-210*
Magnesium	-	11,200-25,100	20,300-32,900	2,650(B)-41,700	6,350-78,000
Manganese	-	38.1-99.9	9.2(B)-1,870	3.7(B)-2,070	9.2(B)-3,590
Mercury	2	ND	ND	0.20(J)-1.0(J)	ND
Nickel	-	ND	47.5	79.4-111	7.10(B)-36.6(B)
Potassium	-	2,110	1,730(B)-2,120(B)	468(B)-12,900	1,090(B)-13,900
Selenium	50	2.4	ND	2.1(B)-33.0	ND
Silver	-	ND	ND	6.9(B)-18.4(J)	ND
Sodium	-	4,690-48,600	5,490-50,700(J)	1,850(B)-78,800	3,380(BJ)-52,300(J)
Thallium	-	ND	ND	ND	ND
Vanadium	-	ND	26.8(B)	4.5(BJ)-106	3.8(B)-12.5(B)
Zinc	-	13.9-24.1	79	6..1(BJ)-390(J)	17(B)-13,600
Cyanide	-	ND	ND	ND	ND

Qualifiers

ND - Below detection limit
B - Analyte found in associated blank as well as in the sample
J - Indicates an estimated value
* - Filtered sample showed concentrations less than the corresponding MCLs
MCL - Maximum Contaminant Level

TABLE 1-3

SUMMARY OF DETECTED INORGANIC ANALYTES (TOTAL) - LEACHATE
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

	MCL (ug/l)	Concentrations Detected by Trench Number TL-1	TL-2	TL-4	TL-5
Aluminum	-	78.1(B) mg/l	301 mg/l	8.47(J) mg/l	356(N) mg/l
Antimony	-	ND	10.5 mg/l	.0726(J) mg/l	ND
Arsenic	50	ND	ND	19 ug/l	ND
Barium	1,000	2.1(B) mg/l	3.7(B) mg/l	.53(B) mg/l	4.7(B) mg/l
Beryllium	-	1.6(BNJ*) mg/l	5.7(NJ*) mg/l	ND	1.5(BNJ*) mg/l
Cadmium	10	2,500(B) ug/l	ND	4.4(B) ug/l	ND
Calcium	-	1.66 mg/l	2.14 mg/l	288 mg/l	.55 mg/l
Chromium	50	4,500(BNJ) ug/l	4,500(BNJ) ug/l	32.9 ug/l	10,000(BNJ) ug/l
Cobalt	-	3,300(BJ) ug/l	ND	13.5 ug/l	ND
Copper	(SMCL) 1,000	11,700(BJ) ug/l	8,800(BJ) ug/l	626 ug/l	3,000(BJ) ug/l
Iron	(SMCL) 300	71.2 mg/l	272 mg/l	17.5 mg/l	254 mg/l
Lead	50	ND	28,300(NJ*) ug/l	505(J) ug/l	ND
Magnesium	(SMCL) 50	89.4(J*) mg/l	205(J*) mg/l	60.3 mg/l	108(J*) mg/l
Manganese	-	ND	9.6(B) mg/l	3.15 mg/l	ND
Mercury	2	420(NJ) ug/l	420(NJ) ug/l	1.3(J) ug/l	ND
Nickel	-	ND	ND	55 ug/l	ND
Potassium	-	ND	ND	27.2	ND
Selenium	10	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND
Sodium	-	ND	415 mg/l	83.4 mg/l	ND
Thallium	-	ND	ND	ND	ND
Vanadium	-	3,000(BNJ) ug/l	4,500(BNJ) ug/l	32.1(B) ug/l	ND
Zinc	(SMCL) 5,000	6,700(B) ug/l	18,400 ug/l	713(J) ug/l	10,700(B) ug/l
Cyanide	-	ND	ND	108 ug/l	48,400 ug/l

Qualifiers

ND - Below detection limits
B - The reported value is less than the contract required detection limit, but greater than the instrument detection limit.
J - Indicates an estimated value
N - Spike sample recovery not within control limits. This value is usable.
* - Duplicate analysis not within control limit. The value is usable.

TABLE 1-4

SUMMARY OF DETECTED VOCS - LEACHATE
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Chemical	MCL (ug/l)	Concentrations Detected by Trench Number TL-1 (mg/l)	TL-2 (mg/l)	TL-4 (mg/l)	TL-5 Red Phase (mg/kg) (organic)	TL-5 Yellow Phase (mg/kg) (aqueous)
Vinyl Chloride	2	47(J)	16	ND	ND	ND
Chloroethane	-	ND	3(BJ)	ND	ND	ND
Methylene Chloride	-	550	18	ND	ND	260(BJ)
Acetone	-	1,300	85	ND	ND	300(BJ)
Carbon Disulfide	-	130	4(J)	ND	ND	ND
1,1-Dichloroethane	-	220	64	5(J)	ND	ND
1,2-Dichloroethene (total)	-	410	66	ND	ND	ND
Chloroform	-	76(J)	ND	ND	ND	ND
2-Butanone	-	420	13	ND	ND	4,100(BJ)
1,1,1-Trichloroethane	200	520	ND	10	ND	ND
Trichloroethene	5	550(J)	11	180	ND	ND
Benzene	5	97(J)	32(J)	ND	ND	ND
4-Methyl 2-pentanone	-	110	9(J)	ND	17,000(J)	410(J)
2-Hexanone	5	ND	ND	ND	29,000(J)	570(J)
Tetrachloroethene	100	48(J)	ND	ND	ND	ND
Toluene	-	1,100	63	ND	480,000(J)	850(J)
Ethyl Benzene	-	640	150	ND	6,400(J)	ND
Styrene	-	ND	3(J)	ND	ND	ND
Xylenes (total)	-	200	330	ND	44,000(J)	77(J)

Qualifiers

ND - Below detection limit.
B - Analyte found in associated blank as well as in the sample.
J - Indicates an estimated value.
MCL - Maximum Contaminant Level

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TABLE 1-5

SUMMARY OF DETECTED SEMI-VOCS - LEACHATE
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

	Concentrations Detected by Trench Number				
				TL-5	
Chemical	**TL-1 (ug/l)**	**TL-2 (ug/l)**	**TL-4 (ug/l)**	**Red Phase (mg/kg)**	**Yellow Phase (mg/kg)**
Phenol	6,600	67	7.2	560 ug/l	ND
Benzyl alcohol	NA	NA	NA	ND	11
2-Methylphenol	440(J)	10(J)	ND	ND	ND
4-Methylphenol	4,200(J)	140(J)	ND	ND	ND
2,4-Dimethylphenol	84(J)	10(J)	ND	ND	ND
Benzoic Acid	NA	NA	NA	ND	9(J)
Naphthalene	ND	ND	4(J)	45(J)	ND
Acenaphthylene	ND	ND	1(J)	ND	ND
Diethylphthalate	ND	49(J)	ND	ND	ND
Phenanthrene	ND	ND	2(J)	ND	ND
Fluoranthene	ND	ND	7(J)	ND	ND
Pyrene	ND	ND	8(J)	ND	ND
Chrysene	ND	ND	5(J)	ND	ND
Bis(2-Ethylhexyl)phthalate	ND	22(J)	ND	180(J)	ND
Benzo(b)fluoranthene	ND	ND	6(J)	ND	ND
Benzo(k)fluoranthene	ND	ND	3(J)	ND	ND
Benzo(a)pyrene	ND	ND	5(J)	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	2(J)	ND	ND
Benzo(g,h,i)perylene	ND	ND	2(J)	ND	ND
Carcinogenic PAHs	ND	ND	21	ND	ND
Non-carcinogenic PAHs	ND	ND	19	ND	ND

Qualifiers

NA - Not analyzed for
ND - Below detection limit
J - Indicates an estimated value
PAHs - Polynuclear Aromatic Hydrocarbons

A/R/HIMCO/AS6

TABLE 1-6

SUMMARY OF DETECTED PESTICIDES/PCBs - LEACHATE
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Chemical Name	TL-01 (ug/l)	TL-02 (ug/l)
alpha-BHC	.017(DJ)	ND
beta-BHC	.097(DJP)	.068(DJP)
Heptachlor	0.12(DJP)	0.023(DJP)
Aldrin	0.13(DJP)	0.12(DJP)
Dieldrin	ND	0.073(DJP)
Endosulfan II	0.17(DJ)	0.048(DJP)
4,4-DDT	0.29(DJP)	ND
alpha-Chlordane	0.22(DJP)	ND
gamma-Chlordane	0.029(DJP)	0.028(DJP)

Qualifiers

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor and alerts data users that any discrepancies between the sample concentrations reported may be due to dilution of the sample or extract. The value is usable.

J - Indicates an estimated value.

P - This flag is used for a pesticide/aroclor target analyte when there is greater than 25 percent difference for detected concentrations between two gas chromatograph columns.

ND - Below detection limit.

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Soil

A summary of inorganic, VOC, and SVOC concentration ranges is presented in Tables 1-7 and 1-8. Arsenic and beryllium were detected in surface soil samples located across the western half of the site, around the quarry pond, and in the south-central area, which is characterized by non-native soil and construction debris (Figure 1-9). The highest concentrations of arsenic were detected in soil samples from the south central area. Beryllium was detected at several locations at relatively consistent concentrations. VOCs were detected widespread across the site (see Figure 1-10). In all cases, VOCs were found at low concentrations (less than 140 ug/kg). SVOC soil contamination was found to be most prominent in samples collected in the south-central area which is characterized by non-native soil and construction debris. Pesticides were detected in two soil samples collected from this area. Figure 1-11 presents locations for SVOC contamination at the site. Table 1-9 presents a range of concentration for SVOCs at the Himco site.

Surface Water and Sediment

Surface water and sediments were sampled from the three site ponds. Analytical results did not reveal significant contamination. Inorganic concentrations were similar to background levels, except for antimony in sediments from the quarry pond which exceeded the background levels. Pesticides and PCBs were not detected in any surface water or sediment samples collected from the three site ponds. VOCs were detected at low concentrations in both surface water and sediment samples (i.e., less than 6 ug/l in surface water and close to background in sediment). Methylene chloride was detected at concentrations ranging from 6 to 120 ug/l in surface water; however, this contamination may be a laboratory artifact. SVOCs were detected at low concentrations only in surface water samples.

Waste Mass Gas

VOCs were detected in all 14 waste mass gas samples collected from the landfill area. However, the concentration of total VOCs was less than 1 part per billion (ppb) in 12 of the 14 samples. VOCs at the other two locations totaled 9.8 ppb and 12.2 ppb, respectively.

Hot Spot

Test pit sampling revealed the presence of a highly contaminated leachate in an area at the southwest border of the landfill. A leachate sample from this area (TL5) contained approximately 48 percent toluene by weight. This location has been referenced as a "hot spot." A site assessment conducted by EPA at this area confirmed contamination with VOCs at this area. As a result of this finding, EPA conducted an emergency removal action which led to the identification and removal of 71 55-gallon drums with generally unidentified contents.

TABLE 1-7

SUMMARY OF DETECTED INORGANIC ANALYTES - SURFACE SOILS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Compound	Background (mg/kg)	Range of Concentrations Detected (mg/kg)
Aluminum	5,100	9.7(B) - 6,780(J)
Antimony	ND	3.1(BJ) - 46.8
Arsenic	1.5	0.47(B) - 5.8
Barium	62	1.3(BJ) - 101
Beryllium	0.69	0.20(BJ) - 0.91(BJ)
Cadmium	ND	1.1(B)
Calcium	386	360(B) - 321,000(J)
Chromium	6.5	1.1(B) - 13.2
Cobalt	3.7	1.5(B) - 5.3(B)
Copper	4.7	1.3(B) - 216
Iron	6,370	9.8(BJ) - 10,100
Lead	7.8	0.5(BJ) - 245(J)
Magnesium	762	14.6(BJ) - 14,000
Manganese	402	1.3(BJ) - 561(J)
Mercury	ND	0.13(J) - 0.54(J)
Nickel	6.5	2.4(B) - 12.0
Potassium	252	86.6(B) - 678(B)
Selenium	0.25	0.27(BJ) - 1.4(J)
Silver	ND	8.49(BJ) - 2.8(BJ)
Sodium	ND	20.8(B) - 90.6(B)
Thallium	ND	ND
Vanadium	11.8	1.6(BJ) - 19.1
Zinc	20.5	1.7(B) - 229
Cyanide	ND	1.3 - 24.3

Qualifiers

ND - Below detection limit
B - Analyte found in the associated blank as well as in the sample
J - Indicates an estimated value

TABLE 1-8

SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS - SURFACE SOILS HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Compound	Background (ug/kg)	Range of Concentrations Detected (ug/kg)
Methylene Chloride	ND	3(J) - 140
Acetone	ND	3(J) - 31
Carbon Disulfide	ND	0.8(J)
1,1-Dichloroethene	ND	5(J)
2-Butanone	ND	2(J) - 8
Tetrachloroethene	ND	6(J)
Trichloroethene	ND	0.9(J) - 4(J)
Toluene	ND	2(J) - 31
Ethyl Benzene	ND	0.7(J) - 2(J)
Styrene	ND	0.8(J)
Xylenes (total)	ND	0.7(J) - 6

Qualifiers

ND - Below detection limit
J - Indicates an estimated value

A/R/HIMCO/AS6

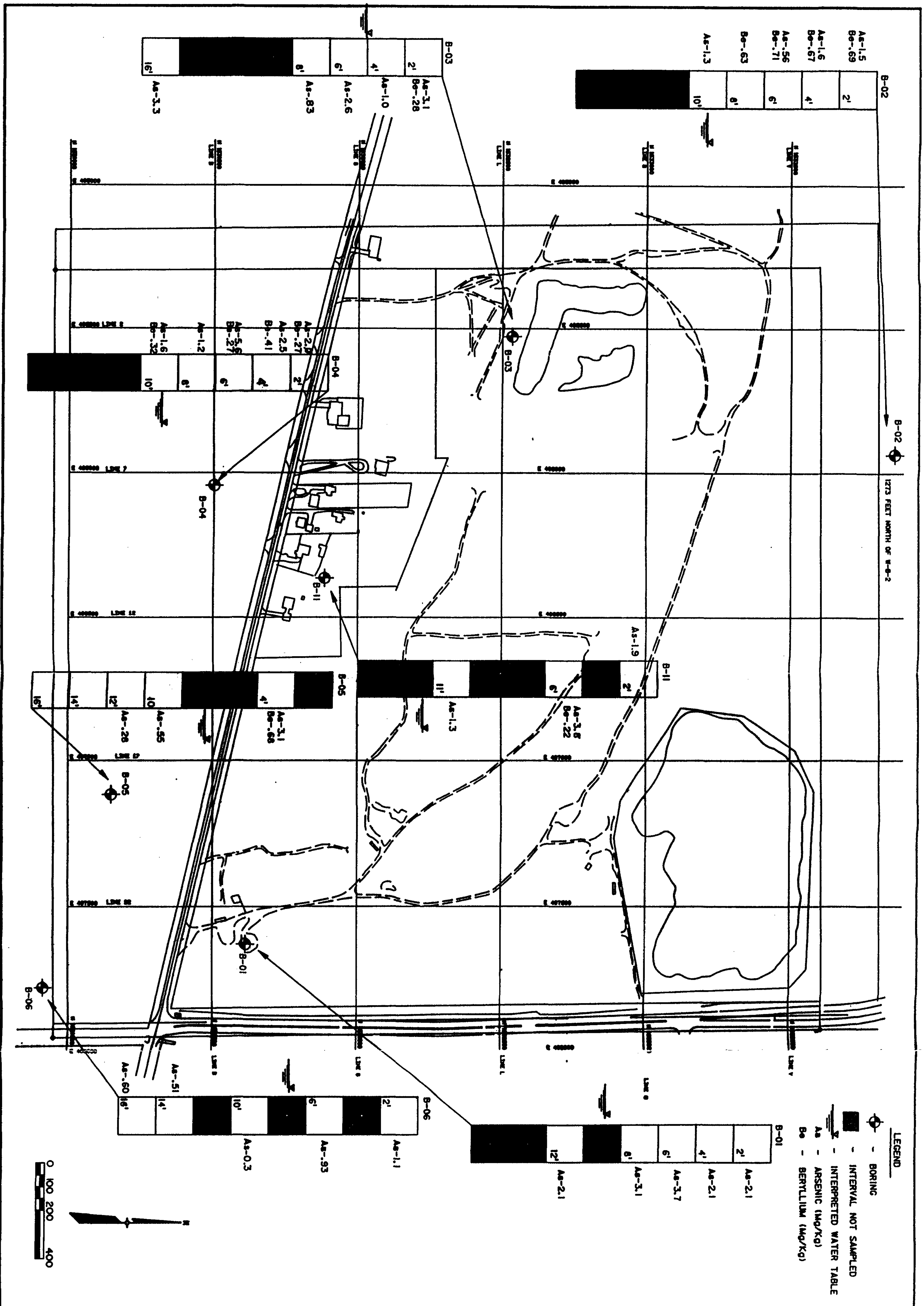

FIGURE 1-9
ARSENIC & BERYLLIUM CONCENTRATIONS IN SUBSURFACE SOILS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

Donohue ENGINEERS ARCHITECTS SCIENTISTS

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JAN. 1992	
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Sheet No.
Project No. 20026
Drawing No. 1-9

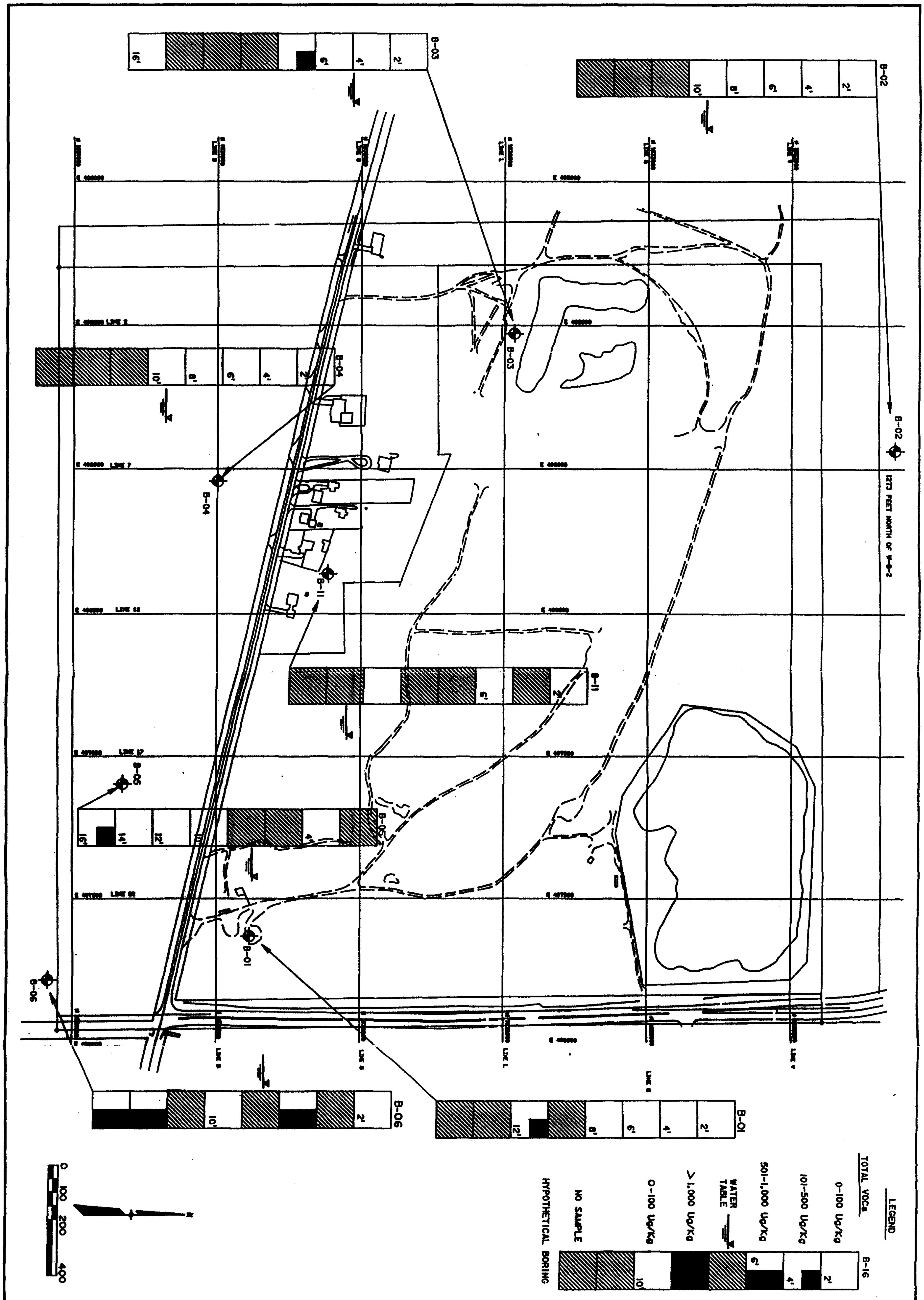

FIGURE 1-10
VOCs DETECTED IN SUBSURFACE SOILS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

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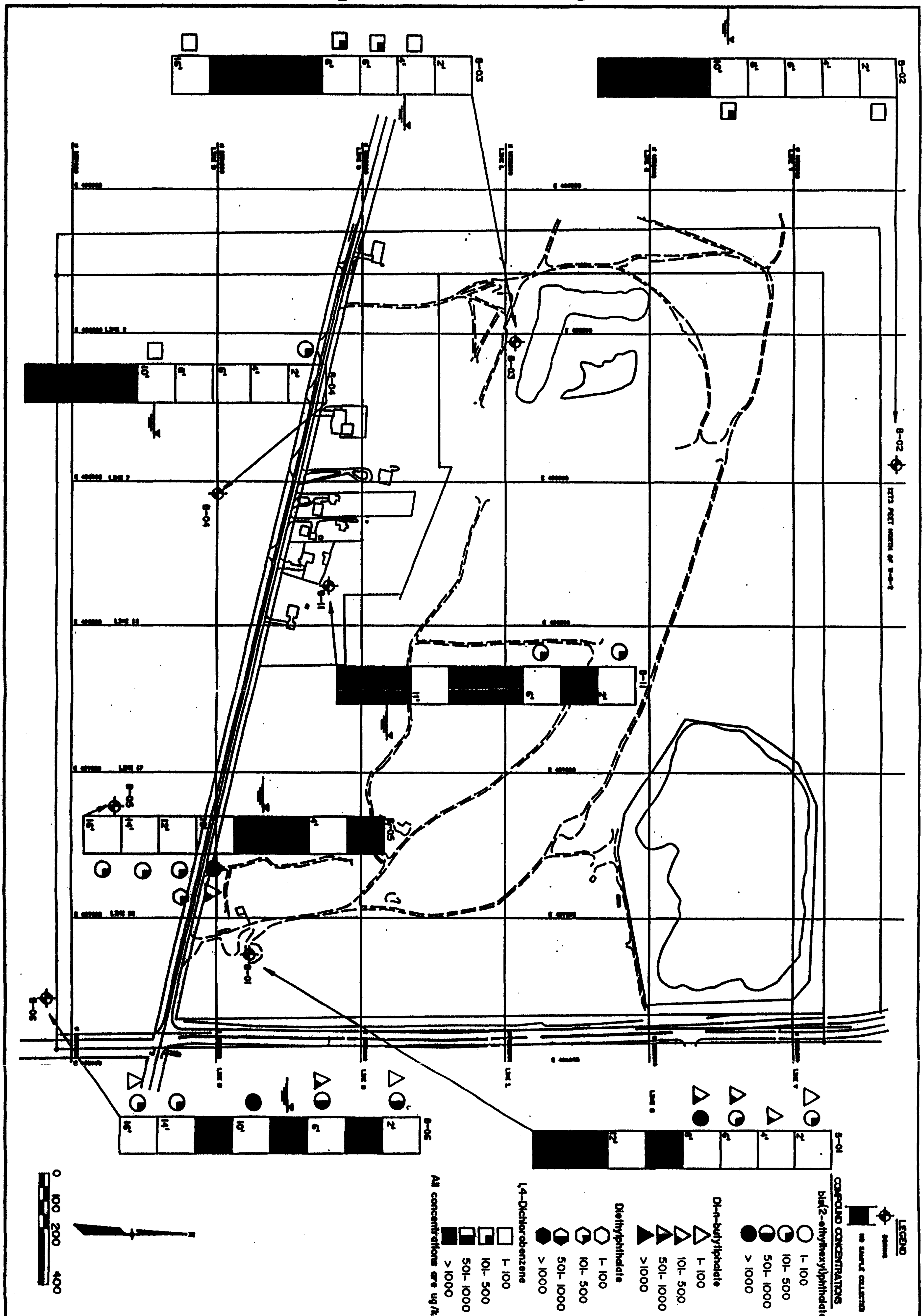

FIGURE 1-11
SEMI-VOLATILE COMPOUNDS DETECTED IN SUBSURFACE SOILS

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

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TABLE 1-9

SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS - SURFACE SOILS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Compound	Background (ug/kg)	Range of Concentrations Detected Above Background (ug/kg)
Naphthalene	ND	18(J)
2-Methylnaphthalene	ND	19(J)
1,4-Dichlorobenzene	80	120(J) - 210(J)
Benzoic Acid	ND	75(J)
Acenaphthene	ND	59(J) - 310(J)
Dibenzofuran	ND	23(J)
Fluorene	ND	43(J) - 120(J)
Phenanthrene	ND	42(J) - 1,500
Anthracene	ND	82(J) - 240(J)
Di-n-butylphthalate	ND	92(J) -490(J)
Fluoranthene	ND	17(J) - 2,800
Pyrene	ND	34(J) - 2,000(J)
Butylbenzylphthalate	ND	300(J)
Benzo(a)anthracene	ND	25(J) - 1,300
Chrysene	ND	37(J) - 1,600
bis(2-Ethylhexyl)phthalate	93	18(J) - 7,800(J)
Benzo(b)fluoranthene	ND	67(J) - 3,200
Benzo(k)fluoranthene	ND	82(J) - 1,700
Benzo(a)pyrene	ND	430(J) - 2,200
Indeno(1,2,3-cd)pyrene	ND	230(J) - 3,700
Dibenzo(a,h.)anthracene	ND	94(J) - 550(J)
Benzo(g,h,i)perylene	ND	250(J) - 3,500
Carbazole	ND	36(J)
Total Carcinogenic PAHs	ND	235(J) - 14,250(J)
Total Noncarcinogenic PAHs	ND	230(J) - 8,340(J)

Qualifiers

ND - Below detection limit
J - Indicates an estimated value

A/R/HIMCO/AS6

1.2.3.4 Chemicals of Potential Concern

Table 1-10 presents the chemicals of potential concern in soil or groundwater at the site as established during the baseline risk assessment. Chemicals were eliminated from consideration in the baseline risk assessment if they were not detected or tentatively identified, or if they are beneficial nutrients, e.g., potassium, zinc, etc. Of these chemicals, 29 (identified by an asterisk [*] in Table 1-10) either pose carcinogenic risk of greater than one in 1 million (1E-6) or noncarcinogenic risk (HI of greater than 1) to future residents based on the results of the baseline risk assessment, or exceed MCLs. The results of the baseline risk assessment are discussed in Section 1.2.6.

1.2.4 Contaminant Fate and Transport

There are several mechanisms that can influence contaminant fate and transport in the environment. These include transformation mechanisms (such as biotransformation, hydrolysis, oxidation, and precipitation); phase change mechanisms (such as dissolution, ion exchange, sorption, and volatilization); and transport mechanisms (such as advection, complexation/chelation, diffusion, and particle-facilitated transport). These mechanisms can cause change, loss, movement, or retardation of contaminants in the environment. The chemical and physical properties of the matrix and the compounds of interest determine the contributions of these mechanisms to contaminant fate and transport. The chemicals of potential concern identified for the Himco site include VOCs, SVOCs, and inorganic compounds. A full discussion of the fate and transport characteristics of these classes of compounds is presented in the RI report (SEC Donohue, 1992). This section summarizes key elements from that document.

The physical and chemical properties of major contaminants found at the Himco site which affect fate and transport are presented in Table 1-11.

1.2.4.1 Volatile Organic Compounds (VOCs)

The potential for VOC mobility is high, and the greatest potential mobility is within the saturated and vadose zones of the sand and gravel deposits at the Himco site. Based on values from Table 1-11 and the ranking system discussed in the RI report, the VOCs of potential concern are ranked as highly volatile, relatively soluble in water, and mobile.

The potential for attenuation/adsorption of organic contaminants within the sand and gravel deposits at the Himco site is low. Sands and gravels typically have low organic matter content which is not conducive to organic compound adsorption within the soil/water matrix. Minor seams of silt and clay were found below the Himco site, but sand

TABLE 1-10

CHEMICALS OF POTENTIAL CONCERN
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

INORGANICS:

Aluminum
Antimony *
Arsenic *
Barium *
Beryllium *
Cadmium *
Chromium *
Cobalt
Iron
Lead *
Mercury *
Nickel
Silver
Thallium
Vanadium *
Cyanide *

ORGANICS:

VOLATILES

1,1-Dichloroethane
1,1-Dichloroethene *
1,1,1-Trichloroethane
1,2-Dichloroethene
2-Butanone
2-Hexanone
4-methyl-2-pentanone
Acetone
Benzene *
Bromodichloromethane *
Carbon disulfide
Chlorobenzene
Chloroethane
Chloroform *
Ethylbenzene
Methylene chloride *
Styrene *
Tetrachloroethene *
Toluene
Trichloroethene
Vinyl chloride *
Xylenes

SEMIVOLATILES

1,4-Dichlorobenzene *
2,4-Dimethylphenol
2-Methylnaphthalene
2-Methylphenol
4-Methylphenol
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene *
Benzo(a)pyrene *
benzo(b)fluoranthene
Benzo(k)fluoranthene *
Benzo(g,h,i)perylene
Benzoic Acid
Benzyl alcohol
bis(2-ethylhexyl)phthalate
Butylbenzylphthalate
Carbazole
Chrysene *
Dibenz(a,h)anthracene
Dibenzofuran
Diethylphthalate
Dimethylphthalate
Di-n-butylphthalate
Di-n-octylphthalate
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene *
Napthalene
Phenanthrene *
Phenol
Pyrene

PESTICIDES/PCBs

4,4'-DDT
4,4'-DDE
Aldrin
alpha-BHC
alpha-Chlordane
beta-BHC
Dieldrin *
Endosulfan II
gamma-Chlordane *
Heptachlor *
Polychlorinated biphenyls
(Aroclor 1248)

NON-CLP CHEMICALS:

Bromide, dissolved
Chloride
Nitrogen, ammonia
Nitrogen, nitrate & nitrite *
Phosphorus
Sulfate

* Contaminants posing carcinogenic risk of greater than 1E-06 or noncarciogenic risk (HI greater than 1) to hypothetical future residents south of the landfill

CLP - Contract laboratory program

TABLE 1-11

PROPERTIES OF DETECTED ORGANIC COMPOUNDS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

	Molecular Weight (grams/mole)	Specific Gravity	Vapor Pressure (mm Hg)	LOG (K_{OW})	LOG (K_{OC})	Henry's Constant at 25°C (atm-m^3/mol)	Vapor Density	Solubility in Water mg/l at 20°C
Volatile Compounds:								
Benzene	78	0.879	76	2.13	1.81	5.43E-03	3.19	1,780
Chloroform			160	1.97	1.64	3.75E-03	4.88	8,220
1,1-dichloroethane	99	1.174	180	1.79	1.48	5.5E-03	4.04	5,500
Bromodichloromethane	163.83	1.98	50	1.88	1.79	2.4E-03	6.70	4,500
1,1-Dichloroethene	97	1.218	591	2.09	1.77	3.84E-1	-	600
Styrene	104	0.905	5	3.16	-	2.28E-3	4.26	300
Toluene	92	0.867	22	2.69	2.15	6.6E-03	3.77	515
Semi-Volatile Compounds:								
1,4-Dichlorobenzene		1.2475					-	0.014
Benzo(a)anthracene	228	1.274	1.16E-9	5.61	6.14	4.5E-6	-	0.014
Benzo(a)pyrene	252 (solid)	1.351	5E-09	6.06	6.74	1.8E-05	-	0.0038
Benzo(k)fluoranthene	252 (solid)	-	9.59E-11	6.06	5.74	3.94E-5	-	.0043
Chrysene	228	1.2741	6.3E-9	5.61	5.30	1.05E-6	-	.006
Dibenzo(a,h)anthracene	278	1.282	1E-10	6.80	6.52	7.33E-8	-	.0025
Indeno(1,2,3-cd)pyrene	276	-	1E-10	6.50	6.20	6.95E-8	-	.000534

- No data available

and gravel deposits are the dominant material below the site from ground surface to bedrock. The potential for organic compound adsorption is greater within the sediment deposits associated with the three site ponds.

The organic compounds at the Himco site may be subject to hydrolysis, degradation through biotic or abiotic processes, oxidation, reductive dehalogenation, or dehydrohalogenation. It should be noted that degradation of organic compounds may result in the formation of daughter products which could be nontoxic or more toxic than the organic contaminant.

Due to the high mobility of the VOC contaminants at the Himco site, the potential for VOC contaminant migration in groundwater appears to be relatively high. The groundwater sampling indicates little impact to groundwater at present. This may be due to factors such as limited leachate entering the aquifer, or sufficient dilution within the aquifer to rapidly reduce the concentrations. Because the leachate volume cannot be quantified, the relative impact of each of the above factors cannot be determined at this time.

Due to the high volatility of VOC contaminants at the Himco site, volatilization through subsurface soils, and migration due to diffusion forces is likely. However, the landfill gas analysis shows very low levels of VOCs, indicating that the amount of volatiles leaving the landfill by this pathway is small. If landfill wastes were to be excavated, volatilization to the ambient environment would be enhanced and might become a more dominant fate mechanism at this site.

1.2.4.2 Semi-Volatile Organic Compounds (SVOCs)

The mobility for SVOCs of potential concern at the Himco site is relatively low. The greatest potential for SVOC mobility is within the saturated zone of the sand and gravel deposits at the Himco site. Based on values from Table 1-11 and the ranking system presented in the RI report, the SVOCs of potential concern are ranked as having low solubilities, are immobile, and have moderate to low volatility.

In general, SVOCs at the Himco site were detected primarily in surface soil samples. Relatively high concentrations were detected in an area located near the south-central edge of the landfill. SVOCs were also detected in leachate. SVOCs are expected to be retained or strongly held in the soils. As expected, only traces of SVOCs were detected in groundwater samples collected during the RI.

In addition, SVOCs at the Himco site may be subject to hydrolysis, degradation through biotic or abiotic processes, and oxidation. Bacteria should be present in the surface soils, and anaerobic conditions probably prevail within the landfill. Degradation of SVOCs may result in the formation of less or more toxic products.

1.2.5 Inorganic Compounds of Potential Concern

Inorganic compounds found at the Himco site characteristically remain in liquid or solid phases. It is anticipated that inorganic compound mobility in the gas phase is insignificant. The solubility of the inorganic compounds arsenic, beryllium, and antimony are dependent on factors that control dissolution, precipitation, and complexation processes. These factors include groundwater solution composition, environmental conditions such as pH and oxidation/reduction potentials, and the inorganic contaminant concentrations. Nitrate/nitrite is not limited by solubility constraints and moves in groundwater with no transformation. Due to the lack of retardation and transformation, nitrate/nitrite is very mobile in groundwater. Nitrate/nitrite would have to transform into NH_3, N_2, or N_2O to become mobile as a gas.

The solubility of arsenate ions (AsO_4^{-3}) in water is dependent on cation solution concentrations. In the presence of metal cations, the solubility of arsenate is less than a few tenths of a milligram of arsenic per liter. The adsorption of arsenate on precipitated ferric hydroxide also limits its solubility in natural systems (USGS, 1982). Beryllium oxide and hydroxide species have very low solubilities. The calculated concentrations of uncomplexed Be^{+2} at a pH of 7.0, based on solubility products, is less than 1 ug/l. At low pH, beryllium ions are adsorbed by clay surfaces or other mineral species in water. At higher pH, beryllium ions form complex species with hydroxides (USGS, 1982). Antimony is insoluble in water; however, antimony chlorides and fluorides are soluble with ranges of 384 to 600 grams/100 ccs of water (Weast, 1984). Cyanide tends to form soluble complexes with iron.

1.2.6 Baseline Risk Assessment

The baseline risk assessment for the Himco site is an analysis of the potential adverse health effects (under current and hypothetical future conditions) to both human populations and the environment resulting from exposures to hazardous substances. By definition, the baseline risk assessment is limited to conditions under the No Action alternative, that is, in the absence of remedial actions (including institutional controls) to mitigate or control releases.

A baseline risk assessment and an ecological assessment were completed as a part of the RI, and the reports for these studies were submitted as a part of the RI report for this site. The results of the risk assessment and ecological evaluation were used to document both the causes and magnitude of risks associated with this site, and to aid in determining if remedial actions are necessary to reduce unacceptable risks. The following sections provide a summary of each.

1.2.6.1 Human Health Evaluation

Selection of Contaminants of Potential Concern

Analytical data collected during the RI were used to determine those chemicals that would form the focus of the quantitative risk assessment. All chemicals detected in either soil, groundwater, leachate, surface water, or sediment were included, with the exception of nine inorganic elements considered to be beneficial nutrients and not detected at levels elevated above those considered essential to human nutrition. As a result, calcium, copper, magnesium, manganese, potassium, selenium, sodium, and zinc were eliminated as chemicals of potential concern. Eighty-seven remaining chemicals were retained for evaluation, as shown in Table 1-10.

Exposure Assessment

Exposure is defined as the contact between a human and a chemical in the environment. An exposure assessment analyzes the possible pathways by which humans can be exposed to contaminants that are present at or released from the site, and provides quantitative estimates of this contact.

No one currently resides or works on the site. On-site trespassers have been observed engaging in recreational activities, including dirt-bike riding, walking, playing, or fishing. There are residences near the site (to the east, west, south, and southeast). There is also commercial and industrial development southeast of the site. With the exception of one drinking water well southwest of the site (Stoner's residence at 28498 County Road 10; a groundwater sample collected from the Stoner well in May 1992 showed no contamination in the well), there is no current downgradient use of the aquifer in the vicinity of the site.

Future development of the site could include several scenarios. Residences or commercial properties could be developed on site, even though such development in certain site areas would not be technically or financially reasonable. At one time, a portion of the site was agricultural and the site could revert back to that use. Additionally, the site could be further developed for recreational uses.

The exposure pathways judged complete for current land uses include: inhalation of airborne particulates or volatiles by residents downwind of the site or dirt-bike riding on the site, ingestion of soil while dirt-bike riding, and ingestion of surface water or sediment while fishing or wading in the on-site ponds. Exposure pathways judged complete for future land uses include both soil pathways (ingestion, inhalation of volatiles or particulates) and groundwater pathways (ingestion, inhalation of volatiles released from groundwater, and dermal exposures) for future residents or workers (including agricultural workers). The exposure pathways and scenarios selected for quantitative evaluation are summarized on Table 1-12.

Each pathway was quantified by:

- Estimating an exposure point concentration (generally the 95th upper confidence limit of the arithmetic average of all samples representative of a given exposure point).

- Estimating a human intake factor which combines all the variables involved in exposure to a contaminant (i.e., ingestion or inhalation rate, exposure duration and frequency, body weight, etc.).

- Comparing the product of the above (the intake) to an appropriate toxicity value.

Risk Summary

The risk of cancer from an exposure to a chemical is described in terms of the probability that an individual exposed for a lifetime will develop cancer. Typically, the EPA requires remediation when total excess cancer risks exceed one in 10,000 (1E-4) (EPA, 1986a). Once remediation starts, EPA targets a risk level of one in 1 million (1E-6). Estimated excess cancer risks for current populations are all below 1E-4. They range from four in 1 million (4E-6) (for the dirt-bike rider) to two in 100 million (2E-8) (for the pond wader).

Excess carcinogenic risks to hypothetical future residents living on the landfill and utilizing groundwater below the site are estimated at two in 10 (2E-1) for adults and seven in 10 (7E-1) for children. These results are summarized on Table 1-13. Nearly all this risk is attributable to pathways involving groundwater (ingestion, inhalation of volatiles released from groundwater, and dermal exposures). The chemicals contributing to this risk include arsenic, beryllium, polycyclic aromatic hydrocarbons (PAHs) and vinyl chloride. A majority of the risk is attributable to beryllium, which was not detected in leachate samples, but was evaluated at one-half of its detection limit.

TABLE 1-12

SUMMARY OF EXPOSURE PATHWAYS SELECTED FOR QUANTIFICATION
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Land Use	Potentially Exposed Population	Exposure Point	Exposure Medium	Exposure Route
Current	Dirt-bike rider	Site	Soil Air	Ingestion Inhalation - Particulates - VOCs
	Wader	Surface water on site (ponds or quarry pit)	Surface water Sediment	Ingestion Dermal contact Ingestion
	Residents (child and adult) northeast of site	Closest downwind residence northeast of site	Air	Inhalation - Particulates - VOCs
Hypothetical Future	Residents (child and adult)	Residence on landfill or south of landfill area	Soil Groundwater	Ingestion Inhalation Inhalation - VOCs Dermal contact
	Workers	Plant or office facility on landfill or south of landfill area	Soil Groundwater	Ingestion Ingestion
	Agricultural Workers	On landfill area	Soil Air Groundwater	Ingestion Inhalation - Particulates - VOCs Ingestion
	Residents (child and adult) northeast of site	Closest downwind residence northeast of site (assuming future agricultural development)	Air	Inhalation - Particulates - VOCs

TABLE 1-13

SUMMARY OF ESTIMATED CARCINOGENIC RISK - HYPOTHETICAL FUTURE RESIDENTIAL POPULATIONS HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Total Excess Cancer Risk
Resident on Landfill:				
Adult	Home	Groundwater	Ingestion	1E-01
			Inhalation - VOCs	4E-04
			Dermal	1E-01
		Soil	Ingestion	5E-05
		Air	Inhalation - Particulates	1E-07
			Inhalation - VOCs	8E-07
			Total	**2E-01**
Child	Home	Groundwater	Ingestion	6E-02
			Inhalation - VOCs	2E-04
			Dermal	6E-01
		Soil	Ingestion	4E-05
		Air	Inhalation - Particulates	1E-07
			Inhalation - VOCs	2E-06
			Total	**7E-01**
Resident South of Landfill - Shallow Groundwater:				
Adult	Home	Groundwater	Ingestion	4E-03
			Inhalation - VOCs	6E-05
			Dermal	1E-04
		Soil	Ingestion	6E-04
			Total	**5E-03**[(a)]
Child	Home	Groundwater	Ingestion	2E-03
			Inhalation - VOCs	4E-05
			Dermal	1E-03
		Soil	Ingestion	4E-04
			Total	**3E-03**[(a)]

TABLE 1-13 (Continued)

SUMMARY OF ESTIMATED CARCINOGENIC RISK - HYPOTHETICAL FUTURE RESIDENTIAL POPULATIONS HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Exposed Population	Exposure Point	Exposure Medium	Exposure Route		Total Excess Cancer Risk
Resident South of Landfill - Deep Groundwater:					
Adult	Home	Groundwater	Ingestion		4E-03
			Inhalation - VOCs		6E-05
			Dermal		1E-04
		Soil	Ingestion		6E-04
				Total	**5E-03(a)**
Child	Home	Groundwater	Ingestion		2E-03
			Inhalation - VOCs		3E-05
			Dermal		1E-03
		Soil	Ingestion		4E-04
				Total	**3E-03(a)**

(a) All risks associated with groundwater are due either to chemicals present in groundwater upgradient of the site or to chemicals not detected at these locations, but conservatively evaluated in the risk assessment at one-half their detection limits.

At a hypothetical residence south of the landfill, the estimated excess cancer risks are in the range of one in 1,000 (1E-3) for either shallow or deep groundwater. Virtually all this risk, however, is attributable either to chemicals present in groundwater upgradient of the site and representative of background conditions (arsenic, beryllium) or to chemicals not detected at these locations but conservatively evaluated in the risk assessment at one-half their detection limit. (Refer to Table 5-9 of the Baseline Risk Assessment, Appendix E to the RI report (SEC Donohue, 1992).) Therefore, it appears that although the groundwater beneath the landfill is contaminated at a level of health concern, this contamination has not moved to (or at least has not been detected at) downgradient exposure points south of the landfill. In addition to groundwater, the soil ingestion pathway contributes a risk of 6 in 10,000 (6E-4) to a future adult resident living south of the landfill area. This risk is attributable mainly to PAHs detected in this area of the site.

Excess cancer risks for similar groundwater exposures for hypothetical future occupational populations are lower than those of residents, but are still above one in 10,000 (1E-4) (Table 1-14).

Other future land uses which do not involve groundwater do not appear to present unacceptable carcinogenic risks to hypothetical future populations.

Noncarcinogenic Effects

The potential for noncarcinogenic effects is evaluated by comparing an estimated intake for a chemical over a specific time period with a reference dose (RfD) derived for a similar exposure period. These ratios are summed for all chemicals and pathways that contribute to the exposure of a given individual. The cumulative ratio thus derived is referred to as a Hazard Index (HI). If a HI exceeds 1 (1E+00), there is some possibility that noncarcinogenic effects may exist, although it does not indicate that such an effect necessarily will occur. No HIs calculated for current populations exceed 1 (1E+00). However, for future populations assumed to utilize groundwater as drinking water, HIs range from 10 (1E+1) (adult resident south of the landfill) to 1,000 (1E+3) (child resident on the landfill). The chemicals contributing to this risk include antimony, arsenic, beryllium, cadmium, chromium, vanadium, and nitrate/nitrite. These results are summarized in Table 1-15. Hazard indices calculated for hypothetical future occupational exposures using groundwater also exceed 1 (1E+00) (Table 1-16).

As was the case for carcinogenic risk, once noncarcinogenic risks attributable to background non-detected chemicals or non-site related chemicals (i.e., nitrate-nitrite) are accounted for, there does not appear to be a concern for noncarcinogenic health effects due to exposures to groundwater south of the landfill. The groundwater beneath the landfill (as represented by the leachate samples) does, however, present a concern for noncancer health effects.

TABLE 1-14

SUMMARY OF ESTIMATED CARCINOGENIC RISK - HYPOTHETICAL FUTURE COMMERCIAL OR AGRICULTURAL USES OR DOWNWIND OFF-SITE RESIDENT HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Total Excess Cancer Risk
Commercial or Agricultural:				
Plant Worker	Landfill	Groundwater	Ingestion	4E-02
		Soil	Ingestion	6E-06
		Air	Inhalation - Particulates	4E-08
			Inhalation - VOCs	2E-07
			Total	**4E-02**
Plant Worker	South of Landfill	Groundwater	Ingestion	1E-03
		Soil	Ingestion	6E-05
			Total	**1E-03(a)**
Agricultural Worker	Landfill	Groundwater	Ingestion	3E-03
		Soil	Ingestion	4E-06
		Air	Inhalation - Particulates	5E-05
			Inhalation - VOCs	2E-09
			Total	**3E-03**
Downwind Off-Site Resident:				
Adult	Home	Air	Inhalation - Particulates	1E-06
			- VOCs	8E-07
			Total	**2E-06**
Child	Home	Air	Inhalation - Particulates	1E-06
			- VOCs	2E-06
			Total	**3E-06**

(a) All risks associated with groundwater are due either to chemicals present in groundwater upgradient of the site or to chemicals not detected at these locations, but conservatively evaluated in the risk assessment at one-half their detection limits.

TABLE 1-15

SUMMARY OF NONCARCINOGENIC RISK - HYPOTHETICAL FUTURE RESIDENTIAL POPULATIONS HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Hazard Index[(a)(b)]
Resident on Landfill:				
Adult	Home	Groundwater	Ingestion	5E+02
			Inhalation - VOCs	2E+00
			Dermal	2E+01
		Soil	Ingestion	2E-01
		Air	Inhalation - Particulates	1E-02
			Inhalation - VOCs	3E-03
			Total	**5E+02**
Child	Home	Groundwater	Ingestion	9E+02
			Inhalation - VOCs	4E+00
			Dermal	1E+02
		Soil	Ingestion	8E-01
		Air	Inhalation - Particulates	7E-03
			Inhalation - VOCs	2E-02
			Total	**1E+03**
Resident South of Landfill - Shallow Groundwater:				
Adult	Home	Groundwater	Ingestion	9E+00
			Inhalation - VOCs	2E-01
			Dermal	8E-01
		Soil	Ingestion	1E-01
			Total	**1E+01**
Child	Home	Groundwater	Ingestion	2E+01
			Inhalation - VOCs	2E-01
			Dermal	3E+00
		Soil	Ingestion	5E-01
			Total	**2E+01**

TABLE 1-15 (Continued)

SUMMARY OF NONCARCINOGENIC RISK - HYPOTHETICAL FUTURE RESIDENTIAL POPULATIONS HIMCO DUMP SUPERFUND SITE ELKHART, INDIANA 1992

Exposed Population	Exposure Point	Exposure Medium	Exposure Route		Hazard Index[(a)(b)]
Resident South of Landfill - Deep Groundwater:					
Adult	Home	Groundwater	Ingestion		4E+00
			Inhalation - VOCs		2E-01
			Dermal		9E-01
		Soil	Ingestion		2E-01
				Total	**5E+00**
Child	Home	Groundwater	Ingestion		9E+00
			Inhalation - VOCs		2E-01
			Dermal		4E+00
		Soil	Ingestion		5E-01
				Total	**1E+01**

(a) Hazard index is subchronic for child populations and chronic for all others.
(b) Except for the "Resident on Landfill" scenario, the risks associated with groundwater for other exposed populations are due to background contaminants.

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TABLE 1-16

SUMMARY OF ESTIMATED NONCARCINOGENIC RISK -
HYPOTHETICAL FUTURE COMMERCIAL OR AGRICULTURAL USES
OR DOWNWIND OFF-SITE RESIDENT
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Hazard Index [a]
Commercial or Agricultural:				
Plant Worker	Landfill	Groundwater	Ingestion	1E+02
		Soil	Ingestion	3E-02
		Air	Inhalation - Particulates	3E-03
			Inhalation - VOCs	3E-04
			Total	**1E+02**
Plant Worker	South of Landfill	Groundwater	Ingestion	1E+00
		Soil	Ingestion	2E-02
			Total	**1E+00**[b]
Agricultural Worker	Plant	Groundwater	Ingestion	1E+01
		Soil	Ingestion	2E-02
		Air	Inhalation - Particulates	4E+00
			Inhalation - VOCs	4E-06
			Total	**1E+01**
Downwind Off-Site Resident:				
Adult	Home	Air	Inhalation - Particulates	1E-01
			- VOCs	3E-03
			Total	**1E-01**
Child	Home	Air	Inhalation - Particulates	5E-02
			- VOCs	1E-02
			Total	**6E-02**

(a) Hazard index is subchronic for child populations and chronic for all others.
(b) The risk associated with groundwater is due to background contaminants.

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Risks from Lead Exposure

Since there are no EPA-approved RfD values for lead, it is not possible to evaluate lead exposure risks using the HI approach. Alternatively, lead can be evaluated by estimating the likely effect of exposure on blood lead levels. The Uptake/Biokinetic model was used to predict this effect based on assumed exposures both from the site and from default values for food and air. The blood lead levels predicted for this site range from 3 to 100 ug/dL. The EPA has identified a 10 ug/dL level of concern for health effects in children. Therefore exposure to lead in the groundwater beneath the landfill poses a cause for concern at this site. However, because lead was detected in background wells at levels comparable to the down gradient wells, lead contamination may not be site-related.

1.2.6.2 Environmental Evaluation

The objectives of the environmental evaluation, or ecological assessment, included characterizing the biological resources at the site and adjacent habitats, and identifying actual and potential impacts to these resources associated with releases of hazardous substances from the site.

Ecological Inventory

The plant communities present on the site include wet and dry prairie assemblages containing over 100 native species of plants. These communities are regionally significant. Conditions on the landfill cap may favor establishment of the state-listed Michaux's stitchwort, but its presence has not been confirmed.

The Indiana bat, star-nosed mole, and badger are the only wildlife species of concern. While the site might provide suboptimal summer habitat for the Indiana bat, site conditions are likely to be suitable for the mole and badger. Aquatic communities in the on-site ponds appear similar to those in a nearby control pond. Although no surface streams drain the site, the St. Joseph River is located two miles to the south and contains a diverse fishery.

A large number of chemicals were detected at least once in soil, surface water, or sediment at the site. Those known to be toxic to ecological populations and which were present in soil above background levels were selected as contaminants of ecological concern. They are summarized in Table 1-17. Potential exposures of ecological concern are summarized in Table 1-18.

TABLE 1-17

CONTAMINANTS OF ECOLOGICAL CONCERN
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Contaminants Present in Soil Above Background

Inorganics	**Organics**
Antimony	bis(2-Ethylhexyl)phthalate
Arsenic	Carbazole
Copper	4,4'-DDT
Cyanide	Dibenzofuran
Lead	1,4-Dichlorobenzene
Mercury	Di-n-butylphthalate
Selenium	Ethylbenzene
Silver	PAHs
Zinc	Toluene
	Xylenes

Contaminants Present in Other Site Media

Surface Water	**Sediment**
Arsenic	Acetone
Chromium	Polychlorinated biphenyls (Aroclor 1248)
Carbon disulfide	bis(2-Ethylhexyl)phthalate
Nickel	Selenium
Zinc	Thallium

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TABLE 1-18

EXPOSURE SCENARIOS FOR ECOLOGICAL POPULATIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Exposure Point	Exposed Population	Exposure Activity	Relative Potential Magnitude of Exposure
L-Pond, Small Pond and Quarry Pond	Benthic invertebrates	Direct uptake, feeding	High
	Fish	Direct uptake, feeding	High
	Phytoplankton	Direct uptake	High
	Zooplankton	Direct uptake, feeding	High
	Resident shorebirds	Ingestion of water, soil, and sediment; feeding	Low to Moderate
	Migratory waterfowl	Ingestion of water, soil, and sediment; feeding	Very Low
	Terrestrial wildlife (including avian)	Ingestion of water, soil, and sediment; feeding	Low to Moderate
	Aquatic macrophytes	Direct uptake	High
	Aquatic organisms exposed to runoff from watershed	Direct uptake, feeding	Low to Moderate
Terrestrial Locations	Terrestrial plants	Growth in contaminated soil; uptake	High
	Terrestrial invertebrates and wildlife (including burrowing animals, soil invertebrates, avian predators, e.g., eagles)	Ingestion of contaminated water and soil; direct contact with contaminated soil; consumption of contaminated plants and animals	Very Low to High
Wetland	Wetland vegetation exposed to runoff and contaminated soil	Direct uptake	Moderate to High

The Himco site is unusual in that conditions on a large area support unique wet and dry prairie plant communities and large numbers of native plant species. This situation is probably related to the nutrient-poor calcium sulfate and sand cover and the historically rich sources of native plant seeds. Because of their regional significance, the prairie communities should be given careful consideration. Efforts should be made to preserve them during remediation.

Contaminants present in the soil where the prairie communities are located are unlikely to pose adverse impacts to resident species of plants and animals. The greatest hazard to resident organisms occurs in the south/southeast area of the site where contamination is higher and more varied. This area is highly disturbed and unlikely to support ecologically significant populations. Small mammals are likely to inhabit this area and may be exposed to contaminants. Other areas of the site are unlikely to pose a significant threat of adverse effects to exposed organisms.

1.3 SITE REMEDIATION APPROACH

Because many CERCLA municipal landfill sites share similar characteristics, they lend themselves to remediation by similar technologies. EPA has established a number of expectations as to the types of remedial alternatives that should be developed during the detailed analysis (EPA, 1991). This eliminates the need to conduct the initial screening of alternatives based on technical feasibility which is suggested under EPA's guidance (EPA, 1988a) for a typical FS. Consequently, for CERCLA municipal landfill sites similar to the Himco site, the FS step of screening the universe of possible remedial alternatives is much more focused. The following sections discuss the strategy for the site remediation.

1.3.1 Groundwater

The results of the RI show that the landfill leachate is contaminated by VOCs, SVOCs, and inorganics. The RI results also show that the site-related impact to groundwater outside the landfill boundary mass is minimal. The results of the human health risk assessment indicate that the site groundwater poses unacceptable carcinogenic and noncarcinogenic risks. However, according to the risk calculation, all risks are due to the background effects or non-site-related contaminants. Additionally, with the exception of lead (which was detected in a background sample at a maximum concentration of 58 ug/l, thus above its MCL of 15 ug/l) and trichloroethene (which was detected at a maximum concentration of 42 ug/l, above its MCL of 5 ug/l), all contaminants were detected below MCLs. This information suggests that the site condition does not warrant groundwater remediation at this time. Therefore, no groundwater cleanup goals and groundwater remediation alternatives will be developed in this FS.

Because there is no liner or natural barrier to impede leachate migration to groundwater, there is a potential for the aquifer downgradient of the site to be unacceptably impacted in the future. To deal with this uncertainty, the FS will develop a groundwater monitoring program to monitor/evaluate groundwater conditions at this site. The scope of the groundwater monitoring program is presented in Appendix A. The groundwater monitoring will be implemented after the Record of Decision (ROD) by EPA or the Indiana Department of Environmental Management (IDEM). The monitoring program is instituted as a means to ensure that groundwater degradation does not occur in the absence of active groundwater remediation. If the monitoring program shows a trend of greater contamination as a function of time, then EPA will assess the real need to implement groundwater treatment.

Because, according to the RI, groundwater outside the landfill boundaries has not been impacted by the site contaminants, cleanup goals for groundwater have not been developed in this FS. A discussion of the proposed levels of contaminants and a mechanism to trigger active groundwater remediation based on the groundwater monitoring data is presented in Appendix A.

Methodologies to protect groundwater quality via source control are discussed in each of the alternatives evaluated in Chapter 4.

1.3.2 Site Soils and Waste

The results of the RI indicate that the waste mass (inferred from the leachate sampling) is contaminated by VOCs, SVOCs, and inorganic compounds. One area designated as a "hot spot" was identified during RI at the southwest corner of the site. This area was remediated by EPA in an emergency removal action. No other "hot spot" is known to exist in the landfill. Additionally, surface and subsurface soil in the areas south of the landfill characterized as the "construction debris area" are contaminated with SVOCs. The results of the baseline risk assessment indicate unacceptable carcinogenic and/or noncarcinogenic risks for human exposures to the landfill contents (primarily due to exposures to leachate in the landfill) and soils in the construction debris area. Because the site is an abandoned landfill, containment, rather than removal or treatment, will be the preferred response action for this site. Further discussions of why containment is a preferred response action are presented in Section 2.5.3. Because containment will eliminate the exposure pathway, thus eliminate the risk, no cleanup goals for the landfill content and contaminated soil in the construction debris area will be developed in this FS.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 INTRODUCTION

In this chapter, remedial technologies and process options are identified and screened based on site-specific information. This process involves five steps:

- Develop remedial action objectives (RAOs) in accordance with EPA's expectations as to the types of remedial alternatives that should be developed for detailed analyses of municipal landfills, as they are listed in the National Contingency Plan (40 CFR 300.430 (a)(1)).

- Develop general response actions (GRAs) for each medium of interest which could be taken to satisfy the site-specific RAOs.

- Identify volumes and areas of contamination for which GRAs may be required.

- Identify technologies and process options from the list of technologies most implemented at municipal landfills (replaces the technical implementability screening recommended in EPA 1988a).

- Screen the technically implementable technologies and process options based on effectiveness, implementability, and cost, to select a representative process option for a detailed evaluation.

Technologies retained after the screening process are assembled into alternatives in Chapter 3.

2.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are site-specific remedial goals for protecting human health and the environment. Because protection may be achieved by both reducing exposure (i.e., by containment such as capping) and reducing contaminant levels (by treatment), RAOs are developed in terms of exposure routes and acceptable contaminant levels. These RAOs may be risk-based contaminant concentrations (cleanup goals) developed from the baseline risk assessment which are protective of human health and the environment. The RAOs may also be based on federal and state ARARs. No risk-based cleanup goals were developed for this site because of the reasons described in Section 2.2.1. The federal and state ARARs that constitute RAOs for the Himco site are described in Section 2.2.2.

Based on the above discussion, RAOs identified for the Himco site include:

- Prevent direct contact with landfill contents and contaminated soils in the construction debris area.
- Control groundwater usage in the vicinity of the site.
- Minimize contaminant leaching to groundwater to ensure that groundwater remains unimpacted by the site contaminants.
- Maintain the long-term cap integrity by incorporating a gas collection system and drainage control measures into the landfill body.

2.2.1 Rationale for Not Developing Risk-Based Cleanup Goals

Contaminant cleanup goals based on health risk are the calculated concentrations associated with a health risk to an exposed population equal to or less than established health risk levels (EPA, 1986a). Acceptable target levels for cancer risk are noted in the National Contingency Plan (NCP) at levels between 1 in 10,000 (1E-4) and 1 in one million (1E-6) excess occurrences of cancer in an exposed population. Cleanup goals can also be developed for noncarcinogenic effects using hazard indices in place of cancer risk estimates. An acceptable noncarcinogenic risk level in accordance with the NCP is a HI less than or equal to 1.0.

Because the target risk level one in 10,000 (1E-4 for carcinogenic risk and HI of 1 for noncarcinogenic risk) are currently exceeded in the background groundwater, the NCP target risk levels cannot be specified for the groundwater downgradient of the Himco site. Additionally, as discussed in Section 1.3.1, RI data indicate that groundwater outside the landfill boundaries has not been impacted by the site contaminants. Thus, at this time there is no need to develop an active groundwater remediation or to develop cleanup goals for this site.

Based on the above discussions, no cleanup goals have been developed for groundwater at this site. However, since the leachate could potentially impact the aquifer, the FS has developed a groundwater monitoring program to monitor the site groundwater condition. The FS has proposed contamination levels for contaminants of concern which would trigger active groundwater remediation (see Appendix A). The monitoring data will be compared with the proposed levels of the contaminants of concern to evaluate whether active groundwater remediation is warranted.

2.2.2 Applicable or Relevant and Appropriate Requirements (ARARs)

The NCP defines "applicable requirements" as being "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." "Relevant and appropriate" requirements are defined as being "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that while not 'applicable' address problems or situations sufficiently similar to those encountered at the CERCLA site such that their use is well suited to the particular site."

ARARs are used for the Himco site to determine the appropriate extent of site cleanup, to scope and formulate remedial action alternatives, and to govern implementation and operation of the selected action. ARARs are considered so that CERCLA responses are consistent with state and federal environmental laws.

As specified in 40 CFR 300.08(a)(3), on-site remedial actions taken at Superfund sites need only comply with the substantive aspects of ARARs. Therefore, permit application and other administrative procedures are not required for actions conducted entirely on-site. However, off-site actions, such as treatment at an off-site treatment, storage, or disposal (TSD) facility, must comply with substantive and administrative requirements.

ARARs are categorized as:

1. Ambient- or chemical-specific requirements
2. Performance, design-, or other action-specific requirements
3. Location-specific requirements

Ambient- or chemical-specific ARARs are values applied to site conditions to establish acceptable levels or concentrations of specific chemicals which may remain in or be discharged to the ambient environment (i.e., used to establish RAOs). Alternatives which involve landfill gas collection and venting to the atmosphere are affected by chemical-specific ARARs regulating air emissions, and ambient air quality. Alternatives which involve groundwater monitoring are affected by chemical-specific ARARs regulating MCLs allowable in the site's groundwater.

Action-specific ARARs are technology- or activity-based requirements or limitations which apply to actions taken at the site. Alternatives which involve leachate extraction and off-site treatment and disposal are affected by action-specific ARARs regulating the transportation and disposal of wastes, and the operation of the receiving treatment, storage, and disposal facility (TSDF).

Location-specific ARARs are restrictions placed on contaminant concentration or remedial activities due to their location. Alternatives which could impact the delineated wetland at the site are affected by location-specific ARARs.

A summary of ARARs and their applicability to the Himco site is presented in Table 2-1.

2.3 IDENTIFICATION OF GENERAL RESPONSE ACTIONS

General Response Actions (GRAs) are defined as actions which will satisfy RAOs and which characterize the range of remedial responses appropriate to various media at a site (EPA, 1988a). These may include institutional controls, containment, extraction, excavation, treatment (in-situ or above ground), post-treatment of residuals, and disposal. Like RAOs, GRAs are medium-specific. Ultimately, combinations of GRAs will be incorporated as composite alternatives for detailed evaluation in Chapter 4.

GRAs are developed from RAOs and other site-specific characteristics. Since the baseline risk assessment performed during the RI indicates that exposure to the landfill wastes, landfill leachate, and contaminated soils in the construction debris area present increased risk to human health and the environment, GRAs are identified to address these exposures. The GRAs identified and their descriptions are presented in Table 2-2.

TABLE 2-1

SUMMARY OF POTENTIAL ARARS

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
FEDERAL					
40 CFR 6, Appendix A Protection of Wetlands	Executive Order 11990	Remediation of municipal landfill sites located next to wetland. Areas will have to be implemented in a manner which minimizes the destruction, loss, or degradation of wetlands.	Location	Applicable	Affects any alternative selected
40 CFR 52 Approval and Promulgation of Implementation Plans	52.770 - 52.797	File an Air Pollution Emission Notice (APEN) with the State to include estimation of emission rules for each pollutant expected. Include with filed APEN the following: * Modeled impact analysis of source emissions * Provide a Best Available Control Technology (BACT) review for the source operation. Predict total emissions of volatile organic compounds (VOCs) to demonstrate emissions do not exceed 450 lbs/hr, 3,000 lbs/day, 10 gal/day, or allowable emission levels from similar sources using Reasonably Available Control Technology (RACT).	Action	Applicable	Air stripping Consolidation of Waste Piles Excavation Land Treatment Process Technologies
40 CFR 60	Subpart WWW	Emission guidelines and Compliance schedules for existing landfills.	Action	To be Considered	Landfill Gas Collection
40 CFR 61 National Emission Standards for Hazardous Air Pollutants	61.01-.06 61.10-.14 61.16-.19	Verify through emission estimates and dispersion modeling that hydrogen sulfide emissions do not create an ambient concentration greater than or equal to 0.10 ppm.	Action	Applicable	Air stripping Consolidation of Waste Piles Excavation Gas Collection Treatment options

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
		Verify that emissions of mercury, vinyl chloride, and benzene do not exceed levels expected from sources in compliance with hazardous air pollution regulations.			
CLEAN WATER ACT (CWA) OF 1977 AS AMENDED [33 U.S.C. 1251]					
40 CFR 122 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)	122.44	Applicable federally approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Action	Applicable	Groundwater Discharge
Water Quality Standards	131				
	122.4	Use of best available technology (BAT) economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.	Action	Applicable	Groundwater Discharge
	122.44(d)(4)	The discharge must conform to applicable water quality requirements when the discharge affects a state other than the certifying state.	Action	Applicable	Groundwater Discharge
	122.44(e)	Discharge limitations must be established for all trade pollutants that are or may be discharged at levels greater than those that can be achieved by technology-based standards.	Action	Applicable	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
CLEAN WATER ACT (CWA) OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)					
	122.44(i) 122.21	Discharger must be monitored to ensure compliance. Discharger will monitor: * The mass of each pollutant discharged. * The volume of effluent discharged. * Frequency of discharge and other measurements as appropriate. Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.	Action	Applicable	Groundwater Discharge
	122	Permit application information must be submitted, including a description of activities, listing of environmental permits, etc. Monitor and report results as required by permit (at least annually). Comply with additional permit conditions such as: * Duty to mitigate any adverse effects on any discharge. * Proper operation and maintenance of treatment systems.			

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
CLEAN WATER ACT OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)					
40 CFR 125 Criteria and Standards for the National Pollutant Discharge Elimination System	125.1-3 125.100 125.104	Establish criteria and standards for technology-based requirements in permits under Sections 301(b) and 482 of the CWA. Develop and implement the Best Management Practices (BMP) program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters. The BMP program must: * Establish specific procedures for the control of toxic and hazardous pollutant spills. * Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure. * Assure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA.	Action	Applicable	Groundwater Discharge
40 CFR 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants	136.1-136.4	Sample preservation procedures, container materials, and maximum allowable holding times are prescribed.	Action	Applicable	Groundwater Discharge
	208(b)	The discharge must be consistent with the requirement of a Water Quality Management Plan approved by EPA under Section 208(b) of the Clean Water Act.	Action	Applicable	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
CLEAN WATER ACT OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)					
40 CFR 144 Underground Injection of Wastes and Treated Groundwater	144.12 144.13 144.14	UIC program prohibits: * Injection activities that allow movement of contaminants into underground sources of drinking water (USDW) and result in violations of MCLs or adversely affect health. * Construction of new Class IV wells, and operation and maintenance of existing wells. Wells used to inject contaminated groundwater that has been treated and is being reinjected into the same formation from which it was withdrawn are not prohibited if part of CERCLA or RCRA actions.	Action	Applicable	Groundwater Discharge
	144.16	All hazardous waste injection wells must also comply with RCRA.			
40 CFR 230 Work Near Wetlands	404(b)(1)	Guidelines for preparing permit for work which may potentially impact wetlands.	Location	Applicable	Cap Design
40 CFR 403 General Pretreatment Regulations for Existing and New Sources of Pollution					
Discharge to POTW	403.5	Specific prohibitions preclude the discharge of pollutants to POTW that: * Create a fire or explosion hazard in the POTW.	Action	R&A	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
CLEAN WATER ACT (CWA) OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)		* Are corrosive (pH <3.0). * Obstruct flow resulting in interference. * Are discharged at a flow rate and/or concentration that will result in interference. * Increase the temperature of wastewater entering the treatment plant that would result in interference, but in no case raise the POTW influent temperature above 104°F (40°C).			
CLEAN AIR ACT of 1963, AS AMENDED [42 U.S.C. 7401]	Section 101	Design system to operate odor free. Devise fugitive and odor emission control plan for this section.	Action	Applicable	Air Stripping Excavation Gas Collection Land Treatment Options
50 FR 30784 July 29, 1985	NA	Applicable federal waste quality criteria for the protection of aquatic life must be complied with when environmental factors are being considered.	Action	Applicable	Groundwater Discharge
52 FR 3748 February 5, 1987	NA	Proposed standards for control of emissions of volatile organics	Action	Applicable	Gas Collection
20 CFR 1910 Water Protection	All Parts	Rules are administered by IOSHA and do not exceed federal requirements.	Action	Applicable	Any portion of alternative involving treatment, consolidation, excavation or discharge.

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901]					
40 CFR 264 Standards for Owners and Operation of Hazardous Waste Treatment, Storage and Disposal (TSD) Facilities					
Disposal and Closure Requirements	264	Area from which materials are excavated may require cleanup to levels established by closure requirements.	Action	Applicable	Excavation
Subpart G	264.18	Post-closure care to ensure that site is maintained and monitored.	Applicable	Action	O&M
	264.71 and 264.72	RCRA permit-by-rule requirements must be complied with for discharges of RCRA hazardous wastes to POTW by truck, rail, or dedicated pipe.	Action	R&A	Groundwater Discharge
	264.111	General performance standard requires minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products. Disposal or decontamination of equipment, structures, and soils. Meet health-based levels of unit.		R&A	Removal/Disposal

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)					
	264.220	Use two liners below the waste, a top liner that prevents waste migration into the liner, and a bottom liner that prevents waste migration through the liner throughout the post-closure period.	Action	Applicable	Containment
	264.221(c)	Prevent overtopping of surface impoundment.	Action	R&A	Surface Impoundments
Subpart X		Standards for miscellaneous units (long-term retrievable storage, thermal treatment other than incinerators, open burning, open detonation, chemical, physical, and biological treatment units using other than tanks, surface impoundments, or land treatment units) require new miscellaneous units to satisfy environmental performance standards by protection of groundwater, surface water, and air quality, and by limiting surface and subsurface migration.	Action	R&A	Treatment Options
Subpart D		Treatment of wastes subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste.	Action	R&A	Treatment Options

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)					
	264.228(a)(i) and 264.258	Removal or decontamination of all waste residues, contaminated containment system components (e.g., liners, dikes) contaminated subsoils, and structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	Action	Applicable	Removal/Disposal
	264.228(a)and(b) 264.258(b) 264.310(a)and(b) 264.117(c) 264.111	Placement of a cap over hazardous waste (e.g., closing a landfill, or closing a surface impoundment or waste pile as a landfill, or similar action) requires a cover designed and constructed to: * Provide long-term minimization of migration of liquids through the capped area. * Function with minimum maintenance. * Promote drainage and minimum erosion or abrasion of the cover. * Accommodate settling and subsidence so that the cover's integrity is maintained. * Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Eliminate free liquids, stabilize wastes before capping (surface impoundments).	Applicable	Action	Capping

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)					
		Restrict post-closure use of property as necessary to prevent damage to the cover.			
		Prevent run-on and runoff from damaging cover.			
		Protect and maintain surveyed benchmarks used to locate waste cells (landfills, waste piles).			
		Disposal or decontamination of equipment, structures, and soils.			
	264.251	Use liner and leachate collection and removal system.	Action	R&A	Waste Piles
Surface Water Control	264.251(c)(d) 264.273(c)(d) 264.301(c)(d)	Prevent run-on and control and collect runoff from a 24-hour, 25-year storm (waste piles, land treatment facilities, landfills).	Action	R&A	Land Treatment Process Technologies
	264.271 264.272 264.273 264.276 264.278 264.281 264.282 264.283	Ensure that hazardous constituents are degraded, transformed, or immobilized within the treatment zone. Maximum depth of treatment zone must be no more than 1.5 meters (5 feet) from the initial soil surface, and more than 1 meter (3 feet) above the seasonal high water table.	Action	R&A	Land Treatment Process Technologies

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)					
		Demonstrate that hazardous constituents for each waste can be completely degraded, transformed, or immobilized in the treatment zone.			
		Minimize runoff of hazardous constituents.			
		Maintain run-on/runoff control and management system.			
		Special application conditions if food-chain crops are grown in or on treatment zone.			
		Unsaturated zone monitoring.			
		Special requirements for ignitible or reactive waste.			
		Special requirements for incompatible wastes.			
		Special requirements for RCRA hazardous waste.			
40 CFR 268 Land Disposal Restrictions	268	Placement on or in land outside unit boundary or area of contamination will trigger land disposal requirements and restrictions.	Action	R&A	Consolidation
		Movement of excavated waste fill to a previously uncontaminated, on-site location, and placement in or on land may trigger land disposal restrictions.	Action	Applicable	Excavation

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)					
		RCRA hazardous wastes are subject to land disposal restrictions. Land disposal restrictions set performance requirements on treatment of the wastes before land disposal. The effective date for final group of RCRA wastes is May 8, 1990. Extensions to the effective dates have been granted for specific RCRA wastes that are contained in soil and/or debris.	Action	Applicable	Removal/Disposal
		All noted and characteristic hazardous wastes or soils and debris contaminated by a RCRA hazardous waste and removed from a CERCLA site may not be land disposed until treated as required by Land Ban. If alternative treatment technologies can achieve treatment similar to that required by Land Ban, and if this achievement can be documented, then a variance may not be required.	Applicable	Action	Closure
STATE					
326 INDIANA ADMINISTRATIVE CODE (IAC)					
Ambient Air Quality Standards	1-3	Elkhart County is in non-attainment for ozone, so new sources of prohibited critical pollutants must be monitored. Pollutants of concern for this site are particulate matter and VOCs. If methane flares are employed, they must be equipped with shutoff valves.	Action	Applicable	Air Stripping Consolidation of Waste Piles Excavation Gas Collection Treatment Options

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
326 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)					
Facility Construction	2	Requires permits for construction of a facility depending upon its potential to emit VOCs. Permit Review Thresholds VOC - 15 lbs/day, 3 lbs/hour, 25 tons/year TSP - 25 lbs/day, 5 lbs/hour, 25 tons/year SO_2 - 20 lbs/day, 10 lbs/hour, 25 tons/year NO_2 - 25 lbs/day, 5 lbs/hour, 25 tons/year CO - 125 lbs/day, 25 lbs/hour, 25 tons/year Lead - 1 ton/year - 5 source types 5 tons/year - other lead source permit levels Facilities with lower emission must be registered.	Action		Air Stripping Consolidation of Waste Piles Excavation Gas Collection Treatment Options
VOC Emissions	8-1-6	This rule establishes limits for VOC emissions from new sources. Best Available Control Technology (BACT) is required for new sources with potential emission of 3 lbs/hour, 15 lbs/day, or 25 tons per year or greater.			

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
326 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)					
Particulate Matter Emissions	6-4	This rule establishes primary and secondary ambient air quality standards necessary to protect public health and welfare for total suspended particulates (TSP), particulate matter with a nominal diameter less than 10 microns (PM_{10}), lead, ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and carbon monoxide (CO). These standards are shown above.			
327 INDIANA ADMINISTRATIVE CODE (IAC)					
Disposal of Wastewater Water Management	2-1	Surface Water Quality Standards are in 327 IAC 2. The rule applies to all waters of the state. "Waters of the state: means such accumulations of water, surface and underground, natural and artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state, but the term does not include any private pond, or any off-stream pond, reservoir or facility built for reduction or control of pollution or cooling of water prior to discharge unless the discharge therefrom causes or threatens to cause water pollution." Although not specifically mentioned, wetlands are included in this definition.	Action	Applicable	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
327 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)					
	2-6	Requires the person responsible for a spill that threatens to enter and damage waters of the state to immediately report the spill to IDEM, immediately notify downstream water users, immediately contain and clean-up the spill, and file reports as required by IDEM.			
	3	327 IAC 3 requires a permit to construct wastewater treatment facility and also for sewer extensions serving a population equivalent of 25 or more, 2,500 gpd or more, or over 300 feet in length, and contains standards for those facilities. Effluent limits must be obtained prior to applying for the construction permit.			
Direct Discharge of Treatment System Effluent	5-2-8 5-2-13 5-2-14 5-2-15	Off-site discharges must obtain a permit pursuant to 327 IAC 5 (NPDES Permit). Effluent limits are obtained from IDEM for either on-site or off-site discharges regardless of the requirement for a permit. Effluent limits are determined on a case-by-case basis. Limits can be requested by a letter containing information including the contaminants and the expected concentrations, volume of treated effluent, name of receiving stream, and proposed POTW and are regulated by the pretreatment sections of 327 IAC 5. Permit may be obtained directly from the POTW if it is delegated. Most large municipal POTWs are delegated. IDEM should be consulted to verify the pretreatment standards of the POTW.	Action	Applicable	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
327 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)					
Public Water Supply	8-1 thru 8-2	Provides public water supply standards for any water which is supplied to the public or is used or available for drinking in any school, resort, camp, hotel, apartment house building, place of employment, or place frequented by the public. Also provides drinking water standards for community water supply serving 25 or more people or 15 service connections. Outlines minimum sampling frequency for groundwater and surface water sources.	Chemical	R&A	Groundwater Discharge
Public Water Supply Construction	8-3	Requires a permit to construct water main extensions larger than 2,500 feet or 5% increase in customers, public water supplies that serve at least 25 persons or 15 connections, supplies serving restaurants, transient housing, or multiple customers through a plumbing system. Facility must comply with sanitary or health regulations and conform to design criteria in "Recommended Standards for Water Works" established by the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, the American Water Works Association Standards, or acceptable to the Commissioner.	Action	Applicable	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL					
Final Cover of Solid Waste Landfill Disposal Facility	2-4 2-14 2-44 3-53-5(a)	Placement of a cap over a landfill requires a cover designed and constructed to: * Provide long-term minimization of infiltration of liquids through the capped area. * Function with minimum maintenance. * Promote drainage and minimize erosion or abrasion of the cover. * Accommodate settling and subsidence so that the cover's integrity is maintained. * Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	Action	Applicable	Capping
Solid and Hazardous Waste Management	2-21	Cleanup waste that is not hazardous is regulated as Special Waste. Waste must be characterized and certified by the State as special waste, then it can be sent to a sanitary landfill approved to accept special waste. Methods of sampling and analysis are the same as for hazardous waste.	Action	Applicable	Treatment Options Disposal Excavation
	3	Indiana has adopted the TCLP for determining characteristic hazardous waste. Indiana also has its own manifest.			Excavation

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL (CONTINUED)					
Security	3-16-5	Sites should be secured in accordance with this rule which: 1. Requires prevention of unknowing and unauthorized entry of persons or livestock if physical contact with the waste, etc., could cause injury or if disturbance of the waste, etc., would cause a violation. 2. The facility must have either: 24-hour surveillance system which continuously monitors and controls entry <u>or</u> an artificial or natural barrier which completely surrounds the active portion <u>and</u> a means to control entry (i.e., a lock) at all times through the gates or other entrances to the active portion. 3. "Danger - Unauthorized Personnel Keep Out" signs are required at each entrance and at other locations sufficient to be seen from any approach, legible from a distance of at least 25 feet.	Action	Applicable	Affects any alternative selected
Contingency Plan	3-18	Existing Hazardous Waste Facility Standards - Contingency Plan and Emergency Procedures, requires that facilities have a contingency plan which minimizes hazards from fire, explosion, or any unplanned sudden or non-sudden release. Emergency coordinator must notify State and local officials specified in the plan.	Action	Applicable	Affects any alternative selected

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL (CONTINUED)					
		Include: 1. Name and telephone number of reporter 2. Name and address of facility 3. Time and type of incident 4. Name and quantity of materials involved 5. Extent of injuries 6. Possible hazards to human health/environment outside facility.			
	3-46-2	General performance standard requires minimization of need for further maintenance; control; minimization, or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.	Action	R&A	Clean Closure (Removal)
	3-46-5	Disposal or decontamination of equipment, structures and soils must meet both state and federal requirements.	Action	R&A Applicable	Clean Closure (Removal) Capping
	3-46-8(d)	Restrict post-closure use of property as necessary to prevent damage to cover.	Action	Applicable	Capping Closure
	3-51-6	Removal or decontamination of all waste residues, contaminated containment system components (e.g., liners, dikes), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	Action	R&A	Clean Closure (Removal)

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL (CONTINUED)					
	3-53-5	Installation of final cover to provide long-term minimization of infiltration.	Action	Applicable	Capping Closure
	3-53-5(b)	Prevent run-on and runoff from damaging cover. Protect and maintain surveyed benchmarks used to locate waste cells.	Action	Applicable	Capping Closure
Surface Water Control	3-53-2(f)(g)(h)	Prevent run-on and control and collect runoff from a 24-hour, 25-year storm during closure and past-closure status.	Action	Applicable	Closure
Excavation	3-40 through 3-54.9	Area from which materials are excavated may require cleanup to levels established by closure requirements.	Action	Applicable	Closure Excavation
INDIANA CODE (IC) DEPARTMENT OF NATURAL RESOURCES					
Construction of Water Treatment Facility	13-2-22	Requires the prior approval of DNR. Project may not 1) restrict the waterway; 2) adversely affect the fish, wildlife, or botanical resources; or 3) be unsafe to life and property.	Action	R&A	Groundwater Discharge
Construction in a Floodway		Permit is required to 1) place, fill, or erect a permanent structure in; 2) remove water from; or 3) remove material from a navigable waterway.	Action	R&A	Groundwater Discharge

TABLE 2-1

SUMMARY OF POTENTIAL ARARS ((CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Affected Portion of Alternative
INDIANA CODE (IC) DEPARTMENT OF NATURAL RESOURCES (CONTINUED)					
Extraction Well	13-2-6.1	Extraction wells with 100,000 gpd capacity requires registration with DNR.			Groundwater Pump and Treat

R&A - Relevant and Applicable
NA - Not Applicable

A/R/HIMCO/AS7

TABLE 2-2

GENERAL RESPONSE ACTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Medium	GRA	Description
Groundwater	Groundwater Monitoring	Groundwater monitoring will be performed to evaluate the effectiveness of the site remedial alternative. This GRA is also required for evaluation as designated by the NCP.
	Institutional Controls	Controls to provide restrictions on groundwater usage in the vicinity of the site will be evaluated
Hot Spot	No action is required	A hot spot was identified and remediated by EPA in May 1992. No other hot spot is known to exist.
Landfill Waste Mass	Containment	A cap on the landfill will be evaluated. This GRA may be protective of human health and the environment by eliminating exposure and minimizing migration.
	Institutional Controls	Deed restrictions and fencing to control human access to the waste mass will be evaluated.
	Removal, treatment, and disposal to an off-site facility	Removal, treatment, and disposal of the highly contaminated waste mass, or hot spots will be evaluated.
	On-site treatment	On-site treatment of the highly contaminated waste mass or hot spots will be evaluated.
Contaminated Soils in the Construction Debris Area	Containment	A cap on the identified construction debris area will be evaluated.
	Institutional Controls	Deed restrictions and fencing to control human access to the waste mass will be evaluated.

TABLE 2-2 (Continued)

GENERAL RESPONSE ACTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Medium	GRA	Description
	Removal, treatment, and disposal to an off-site facility.	Removal and disposal of the SVOCs contaminated soils will be evaluated.
	On-site treatment	On-site treatment of the SVOCs contaminated soil will evaluated.
Landfill Gas	Gas collection and treatment	Collection and treatment of the landfill gas will be evaluated.
Landfill Leachate	POTW disposal	Collection, on-site treatment, and disposal of the landfill leachate to a POTW will be evaluated.
	TSDF disposal	Collection, treatment, and disposal of the landfill leachate to a TSDF will be evaluated.
	On-site treatment	On-site treatment of the collected leachate will be evaluated.

2.4 IDENTIFICATION OF AREAS AND VOLUMES OF CONTAMINATION

The areal extent of the landfill was determined using a combination of geophysical survey, analysis of test pits and soil borings, and examination of the site aerial photos. Based on this investigation, the landfill boundaries were determined as presented in Figure 1-3. Using the estimated area of the landfill and assuming an average depth of 13 feet, the total estimated waste volume in the landfill is approximately 1.2 million cubic yards.

Leachate was encountered in nearly all test pits excavated at this site. Infiltrating precipitation is considered the primary source of the leachate. The rate of leachate generation has been estimated using the Hydrogeologic Evaluation of Landfill Performance (HELP) model for the current condition as well as for conditions with single barrier and composite barrier cap. The basis of this calculation and resulting leachate generation rate are presented in Appendix A. According to this calculation, the annual leachate infiltration rates are 5.9, 3.7, and 0.001 million gallons per year for current condition, single cap, and composite cap, respectively.

As a result of the decomposition of wastes in the landfill, gas is generated composing of various compounds. Gas generation rate is a function of landfill composition, age of material in the landfill, oxygen concentration, moisture content, and available nutrients. An estimate of the gas generation rate has been made and presented in Appendix A. According to this estimate, the gas generation rate in this landfill is estimated at $7.78 * 10^6$scf/year.

2.5 SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

In Section 2.3, the GRAs that will satisfy the RAOs were identified for the Himco site. In this section, remedial technologies and related process options related to the GRAs are identified and screened based on technical feasibility. Figure 2-1 presents a list of process options evaluated for this site. During this evaluation, unit process options are evaluated on the basis of effectiveness, implementability, and cost to select a representative process option for each technology type. In general, the evaluation focuses on effectiveness while implementability and cost play a limited role in this screening step. When appropriate, only one process option is selected to represent each technology type in order to simplify subsequent development and evaluation of the alternatives. The following text presents further discussions of the process options evaluated for each of the waste matrices outlined on Figure 2-1.

A detailed description of the technologies considered for evaluation during this initial screening process at the Himco site is presented in Appendix B.

FIGURE 2-1
EVALUATION OF PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Response Action	Remedial Technologies	Process Options	Description	Effectiveness	Implementability	Cost
GENERAL						
No Action	None	No Action	None	Does not achieve Remedial Action Objectives (RAOs) May not be acceptable to local public or government.	None required.	None
Institutional Controls	Restriction On Groundwater Use	Restriction On Groundwater Use	Institute restriction on pumping from the aquifer in the vacinity of the site.	Does not achieve RAOs. May be used in conjunction with other process options; and may be acceptable to public or local government when combined with additional process options.	Readily Implementable.	Low
	Access Restrictions	Deed Restrictions	Institute deed restriction for landfill proper and construction debris areas.	Does not achieve RAOs. May be used in conjunction with other process options; and may be acceptable to public or local government when combined with additional process options.	Readily Implementable.	Low
		Fencing	Fence landfill proper and construction debris areas to isolate and minimize direct contact with contaminated landfill contents and soils.	Does not achieve RAOs. May be used in conjunction with other process options; and may be acceptable to public or local government when combined with additional process options.	Readily Implementable.	Moderate
GROUNDWATER						
Institutional Controls	Groundwater Monitoring	Groundwater Monitoring	Monitor existing and new monitoring wells by conducting regular groundwater sampling.	Routine groundwater monitoring is effective to evaluate variations in groundwater quality over time.	Readily Implementable.	Low

Option retained for further consideration.

Option eliminated from further consideration.

FIGURE 2-1
EVALUATION OF PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Response Action	Remedial Technologies	Process Options	Description	Effectiveness	Implementability	Cost
			LANDFILL WASTE MATERIAL			
			"HOTSPOT" Area			

One "Hot Spot" area was identified and remediated by EPA in an emergency removal action in May 1992. No other "Hot Spot" areas are known to exist; therefore no other response actions are being considered.

FIGURE 2-1
EVALUATION OF PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

LANDFILL WASTE MASS

Response Action	Remedial Technologies	Process Options	Description	Effectiveness	Implementability	Cost
Removal of Waste Fill Material	Excavation	Excavation	Soil removal using standard earth moving equipment, shoring, and common construction practices.	Effective in removal of contaminant source.	An extensive volume of waste mass to be excavated requires the availability of a receiving TSDF capable availability of a receiving TSDF capable of accepting and treating these materials. Not implementable.	High
Treatment of Waste Fill Material	Thermal Treatment	Rotary Kiln Incineration	A cylindrical, refractory lined shell at an inclined axis that rotates to provide mixing of materials and combustion air while heating wastes to combustion temperatures.	Achieves complete destruction of organic contaminants.	An extensive volume of waste mass to be excavated requires the availability of a receiving incinerator capable of processing these materials. Not implementable.	High
	Soil Washing and Effluent Treatment	Surfactant Washing and Biological Treatment	Actived bacteria used to aerobiclydigest hazardous organic constituants or decompose them into non-hazardous constituents.	Effective in removing hazardous organic constituants below NPDES or POTW requirements.	An extensive volume of waste mass to be excavated requires the availability of a receiving soils washing facility capable of processing these materials. Not implementable.	High
		Acid Washing and pH Adjust/Precipitation	pH adjustment and chemical reaction to precipitate soluble hazardous metal ions.	Effective in removing hazardous metal ions below NPDES or POTW requirements.	An extensive volume of waste mass to be excavated requires the availability of a receiving soils washing facility capable of processing these materials. Not implementable.	High
Disposal of Waste Fill Material	Landfill Disposal	Off-site Landfill	Off-site disposal of the waste fill material at an approved landfill.	Efective disposal of waste fill material at an off-site facility.	An extensive volume of waste mass to be excavated requires availability of a landfill facility capable of accepting the waste mass excavated.	High
Containment of Waste Fill Material	Capping	Single Barrier Cap	A single barrier cap coving the landfill eliminates exposure to the media and reduces the infiltration of precipitation, and human and ecological exposure.	Effective in eliminating exposure to landfill waste mass. Effective in reducing leachate generation.	Readily implementable. Maintenance of cap required.	Low
		Composite Barrier Cap	A composite barrier cap covering the landfill eliminates exposure to the media and eliminates infiltration of precipitation, and human and ecological exposure.	Effective in eliminating exposure to landfill waste mass. Effective in eliminating leachate generation.	Readily implementable. Maintenance of cap required.	Moderate

Option retained for further consideration.

Option eliminated from further consideration.

FIGURE 2–1
EVALUATION OF PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

SVOCs Contaminated Soils
in the Control Debris Area

Response Action	Remedial Technologies	Process Options	Description	Effectiveness	Implementability	Cost
Removal of SVOC Material	Excavation	Excavation	Soil removal using standard earth moving equipment, shoring, and common construction practices.	Effective in removal of contaminant source.	Not readily implementable as it requires availability of a TSDF capable to accept and treat the waste material.	High
Treatment of SVOC Material	Thermal Treatment	Rotary Kiln Incineration	A cylindrical, refractory lined shell at an inclined axis that rotates to provide mixing of materials and combustion air while heating wastes to combustion temperatures.	Achieves complete destruction of organic contaminants.	Not readily implementable as it requires availability of a incinerator to accept and incinerate the waste material.	High
	Soil Washing and Effluent Treatment	Surfactant Washing and Biological Treatment	Actived bacteria used to aerobicly digest hazardous organic constituants or decompose them into non–hazardous constituents.	Not effective for removing SVOCs from soil because of the strong bonds between soil particles and SVOCs.	Not readily implementatable as it requires a treatability study to assess design parameters.	High
Disposal of SVOC Material	Landfill Disposal	Off–site Landfill	*Off–site disposal of the waste fill material at an* approved landfill.	Efective disposal of waste fill material at an off–site facility.	Not readily implementable as it requires availability landfill disposal facility capable of accepting the waste materials excavated.	Moderate
Containment of Waste Fill Material	Capping	*Single Barrier Cap*	A single barrier cap coving the SVOC soils and *hazardous constituants to reduce the infiltration of* precipitation, and human and ecological exposure.	Effective in reducing the generation of leachate.	Readily implementable. Maintenance of cap required.	Low
		Composite Barrier *Cap*	A multiple barrier cap covering SVOC soil material constituants capable of eliminating infilitration of *precipitation, and human and ecological exposure.*	Effective in eliminating or significantly reducing the generation of leachate.	Readily implementable. Maintenance of cap required.	Moderate

Option retained for further consideration.

Option eliminated from further consideration.

FIGURE 2–1
EVALUATION OF PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

LANDFILL LEACHATE

Response Action	Remedial Technologies	Process Options	Description	Effectiveness	Implementability	Cost
Collection of Leachate	Collection and Pumping	Leachate Extraction Wells	Removal of leachate from the landfill with the use of pumps and a piping sytem.	Effective for removing leachate from landfill.	Readily Implementable.	Moderate
Treatment of Leachate	On-site Physical Treatment	Air Stripping (VOC removal)	Removal of volatile organic contaminants from a liquid by contacting the liquid with a countercurrent air stream in a packed tower.	Effective proven process for the removal of VOCs constituents from an aqueous stream. Exiting air stream may require further abatement to meet air emisssion standards for VOCs.	Readily Implementable technology, however, will require treatability testing to assess process design parameters.	High
		Carbon Absorption (Semi-volatile Removal)	Removal of volatile and semi-volatile organic contaminants from a liquid by contacting that liquid with activated carbon material.	Effective process for the removal of organic constituents from an aqueous stream. Carbon adsorption material will require periodic regeneration to remove organic constituants captured.	Readily Implementable technology, however, will require treatability testing to assess process design parameters.	High
	On-site Chemical Treatment	Chemical Precipition (Metals removal)	Removal of soluble hazardous metal constituents from a liquid by precipitating the soluble metal ions as insoluble metal salt precipitant.	Effective process for the removal of soluble metal constituents from an aqueous stream. Precipitated metal salts will need to be stabilized and disposed of in a landfill.	Readily Implementable technology, however, will require treatability testing to assess process design parameters.	High
Disposal of Leachate	Off-site Disposal	Disposal at POTW	Discharge of untreated leachate to POTW via truck shipment.	Effective disposition for untreated leachate.	POTW not readily available to accept material as is, will require analytical testing and possible pretreatment to atttain compliance with POTW requirements.	Moderate
		Disposal at TSDF	Discharge of untreated leachate to TSDF via truck shipment.	Effective disposition for untreated leachate.	Readily implementable. Will require periodic analytical testing to monitor TSDF requirements.	High

Option retained for further consideration.

Option eliminated from further consideration.

FIGURE 2-1
EVALUATION OF PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

LANDFILL GAS

Response Action	Remedial Technologies	Process Options	Description	Effectiveness	Implementability	Cost
Collection of Landfill Gas	Gas Collection	Passive Gas Collection	Collection of subsurface landfill gas with the use well points and interconnection piping.	Effective for collecting methane in the landfill. Not effective if additional treatment of the landfill gas is required.	Readily implementable.	Moderate
		Active Gas Collection	Collection of subsurface landfill gas with the use well points and interconnection piping and a blower or compressor.	Effective for removing methane and other VOC gases from landfill.	Readily implementable.	Moderate
Treatment of Landfill Gas	Thermal Treatment	Enclosed Ground Flare	Collected gas is burned at a high temperature in a controlled manner. This process option will be completed if sufficient methane is present in the landfill.	Effective for distroying methane and other non-chloronated VOC ontaminants in the landfill gas collected.	Readily implementable.	Moderate
	Carbon Adsorption	Vapor Phase Activated Carbon	Collected gass is passed through vapor phase activated carbon to remove VOC comtaminants.	Effective for removing VOC contaminants in the landfill gas collected.	Readily implementable.	Moderate

Option retained for further consideration.

Option eliminated from further consideration.

2.5.1 No Action

The NCP requires that the No Action alternative be considered for all sites. It provides a baseline for comparing all other remedial alternatives.

Under the No Action alternative for the Himco site, contaminated soils and fill material would be left in place, undisturbed. The carcinogenic and noncarcinogenic risks would be the same as the baseline risk (see Tables 1-13 through 1-16). The resultant risk has been identified in the baseline risk assessment to be two in 10 (2E-1, carcinogenic risk for a hypothetical adult resident on the landfill) and 70 (noncarcinogenic risks, 70 times the acceptable level for a hypothetical adult resident on the landfill).

2.5.2 Institutional Controls

Institutional controls are used to protect human health or the environment by restricting present and future use of the property as well as groundwater use in the site vicinity. Such restrictions are imposed by legal instrument (e.g., laws, regulations, owner-imposed restrictive covenants in deeds, etc.). Furthermore, institutional controls may place restrictions on site development which could preclude future residential development. Possible institutional controls for the Himco site include deed restrictions and fencing.

Because institutional controls keep the source of contamination intact, all current and potential future risks remain intact. No reduction of toxicity, mobility, or volume of the contaminated soils results from the use of institutional controls. Past experiences with similar projects indicate that institutional controls are generally difficult to implement. As such, institutional controls alone do not effectively protect human health and the environment.

2.5.3 Landfill Contents and Contaminated Surface Soil South of the Landfill

<u>Removal of Contaminated Waste Mass and Soil and Disposal to an Off-Site Facility</u>

This removal technology maybe applicable for treatment of "hot spots" in the landfill. However, the "hot spot" identified at the Himco site was removed by EPA in an emergency removal action in May 1992. No other "hot spots" are known to exist. Excavation and off-site disposal of the entire waste mass (approximately 1.2 million cubic yards) would be an extensive undertaking with no guarantee of substantial improvement in mitigating the site risks. Furthermore, excavation of the landfill content would likely cause severe odor and fugitive dust emissions as a result of disturbing the existing fill. This remedial action is, therefore, not a realistic solution for remediating the entire site mass. This technology may, however, be applicable for treating the SVOCs contaminated surface soil south of the landfill.

Typical equipment used in the removal includes drag lines, loaders, dozers, pans (scrapers), trucks, and backhoes. Excavated fill material can be loaded onto trucks and hauled off-site to an approved TSDF. Depending on the waste characteristics, Land Disposal Restriction (LDRs) may be applicable to the disposal of this material in a landfill. Therefore, this alternative may need to be used in conjunction with a soil treatment technology. The high cost associated with excavation, treatment, and disposal makes this alternative less attractive relative to a capping alternative, which may be constructed in conjunction with the landfill cap. As such, this alternative is not retained for further evaluation.

Thermal Treatment of the Contaminated Soil by Incineration

Excavation and thermal destruction of the entire waste mass is not a viable consideration based on the tremendous quantity of wastes requiring treatment. This process option is applicable to remediate "hot spots," but no "hot spot" is known to exist at this site.

However, this process option may be applicable for on-site treatment of the SVOCs contaminated surface soil found south of the landfill. The excavated soil material would be treated in a rotary kiln furnace. A rotary kiln furnace is a rotating, inclined, refractory-lined cylinder into which the waste material is introduced for direct combustion. Organic contaminants are destroyed by incineration at high temperatures within the kiln. The kiln must also include an off-gas treatment system to remove combustion particulates, acid gases, and non-combustible, volatilized metals. The ash produced from combustion is inert but will require appropriate disposal. Incineration technology has been demonstrated successfully on a wide variety of combustible waste materials and contaminated soils. However, incineration will not destroy metal contaminants present in the waste fill material, but converts these contaminants into oxides which remain in the ash.

The extremely low energy levels expected in the sandy soil would require an inordinate amount of auxiliary fuel to maintain the high temperatures necessary for thermal decomposition of the organic contaminants. This condition makes implementation of this process option very costly. Additionally, because of the residential zoning of the site, minimizing nuisance as well as community acceptance may be major obstacles for implementation of this alternative. Therefore, thermal treatment is not retained for further evaluation as an alternative.

Soils Washing Treatment of the Contaminated Soil

This process option is not applicable to the waste mass because no known "hot spot" exists at this site. However, this process option is applicable for the on-site treatment of the SVOC contaminants found south of the landfill.

The soil-washing process extracts contaminants from soil using water or an aqueous solution composed of chelating agents, surfactants, acids, or bases. Formulation of suitable washing fluids that limit toxicity may be difficult due to the complexity of waste materials being treated. Recovery of the washing fluids for reuse is necessary for the economic viability of the process. Furthermore, due to variations in the waste composition, frequent reformulation of washing fluids may be necessary.

The soil washing could be accomplished on-site by placing the excavated fill material in large vessels and using water and washing solution to remove the organic contaminants. The washed material would then be dewatered, dried, and disposed of in a landfill. LDRs may be triggered by this process option. The resultant surfactant/detergent solution should be treated by biological treatment to remove organic contaminants before disposal. Another concern is the efficiency of soil washing to extract or remove contaminants of concern from the soil matrix. Because SVOC contaminants are strongly bound to soils or asphalt debris, soil washing is not expected to be efficient for removal of these contaminants. Additionally, site logistics and difficulties associated with collecting and recycling the wash water make this alternative not viable for this site. Therefore, this process option is not retained for further evaluation.

Containment

Technologies for containment are designed to keep the hazardous materials within the site boundaries. Containment does not treat the contaminants, but reduces human health risks by reducing exposure routes.

A cap on the landfill would prevent direct contact with the waste mass, reduce infiltration into the landfill, and thereby reduce the potential migration of contaminants from the landfill into the groundwater. Two types of caps are evaluated for this site. A single barrier cap may consist of an upper vegetated soil layer with an underlying drainage layer and a low permeability clay layer. A composite barrier cap includes all components of a single barrier cap along with the addition of a flexible membrane liner. The primary differences in effectiveness between a single barrier and a composite barrier solid waste cap are that the composite barrier cap provides an added level of landfill gas containment and greater control over infiltration into the waste mass. These process options are retained for further evaluation.

2.5.4 Landfill Gas

The Himco site produces landfill gas (LFG) naturally due to the decomposition of organic material in the dump. The EPA guidance document states that LFG collection should be evaluated during the FS if the following situations exist at the site: (1) homes and buildings are within 1,000 feet of the landfill; (2) the final land use of the landfill involves use by the public; and (3) the landfill produces excessive odors (EPA, 1991). Situation 1 is definitely applicable to the Himco site. It can be argued that Situation 2 is applicable because the site is used for hunting, dirt-bike riding, hiking, etc. It can also be argued that Situation 3 is applicable because nearby residents complained to the SEC Donohue RI field team about the "terrible" odors coming from the landfill, especially during the summer months. For these reasons, gas collection and treatment are included as a component of each of the system alternatives evaluated.

Gas Collection

Gas collection involves capturing the LFG that is naturally produced due to the decomposition of organic material deposited at this site. Both passive and active gas collection systems are discussed below.

Passive LFG systems use a system of gas extraction wells installed throughout the landfill and interconnection pipes to collect the gas without the use of any mechanical device to force the gas into the collection system. The accumulated gas in these wells are discharged directly to the atmosphere by means of a series of pipe vents. Disadvantages of using pipe vents include their small zone of influence (typically less than 5 feet in waste material) and the fact that passive systems cannot be combined with an off-gas treatment system because of the lack of sufficient pressure to force the gas through the treatment systems. The net result is that VOC emissions and noxious odors would be anticipated from the Himco site. For these reasons, passive gas collection and discharge to the atmosphere are not further considered.

An active LFG control systems uses the same system of gas extraction wells and interconnecting piping as does the passive LFG system except that a mechanical blower or compressor is employed to create a negative pressure gradient to force the landfill gas into the system. This system is easily implementable, can be used in series with subsequent gas treatment processes, and is not significantly more expensive than a passive system. Therefore, active gas collection is retained for further consideration.

Gas Treatment

The technologies to be evaluated for LFG treatment are thermal treatment and vapor phase carbon adsorption.

Thermal treatment to destroy methane, some odoriferous compounds, and other flammable components of the collected LFG is accomplished by using enclosed ground flares. Flaring systems typically consist of mixing the process stream, in this case the collected LFG, with an auxiliary fuel and feeding the mixture through a vertical, open-ended stack-like vessel. A pilot burner of natural gas is used to ignite the mixture. This emerging technology is recognized as Best Available Control Technology (BACT). It represents an improvement from a perception perspective over open flares, which have traditionally been used in similar situations. This process option is retained for further consideration.

Vapor phase activated carbon (VPAC) is used to remove a wide range of contaminants from the LFG prior to its release to the atmosphere or to the flare stack. VPAC is capable of removing chlorinated and sulfur-containing hydrocarbons from the LFG stream but has little or no effect on capturing methane. VPAC is effective for VOC removal and odor control. This process option is retained for further evaluation.

2.5.5 Landfill Leachate

Leachate Collection

Implementation of a leachate collection system at the Himco site would entail the construction of a series of extraction wells optimally positioned throughout the landfill site to collect leachate via submersible pumps at each well location or via a vacuum pump at the point of collection and treatment. Leachate from the well locations is collected via the interconnecting piping to a holding tank for treatment and disposal. Appendix A presents discussion on the leachate collection system and leachate generation rate at the Himco site. This process option is retained for further consideration.

On-Site Treatment

The feasibility of treating leachate depends on the contaminants present, their concentration, and the physical/chemical properties of the contaminants in the leachate. In general, for the leachate at the Himco site, a "process train" of several unit technologies in series must be forwarded since no one unit process is capable of treating the range of organic and inorganic contaminants detected in the leachate. The following paragraphs briefly discuss a number of the unit technologies which may be applicable.

Air stripping can be used to remove VOCs in the leachate. Depending on the solubility and volatility of these contaminants, air stripping is capable of achieving removal efficiencies of greater than 95 percent. Factors affecting removal efficiencies include the vapor pressure and solubility of contaminants in the aqueous phase, the temperature of the aqueous phase, the air-to-water ratio, and the physical characteristics of the air stripping equipment. Most of the VOCs found in leachate at the Himco site are amenable to removal by air stripping.

As another alternative, carbon adsorption can be used to remove organic contaminants from the leachate. Activated carbon has been shown to remove many organic contaminants and some inorganic contaminants to levels below analytical detection limits. The process of adsorption using activated carbon involves contacting a waste stream with the carbon, usually by flow through a series of packed bed absorbers. The activated carbon selectively adsorbs constituents in the water by the surface attraction phenomenon. Factors affecting adsorption include the strength of the molecular attraction between adsorbent and contaminants, molecular weight, type and characteristics of adsorbent, electrokinetic charge, pH, and surface area. Once the micropore surfaces are saturated with contaminants, the carbon is "spent" and must either be replaced with fresh carbon or thermally regenerated. Use of carbon adsorption for the continuous removal of VOC contamination will require periodic regeneration.

Chemical precipitation can be used to remove inorganic contaminants from the leachate. Precipitation is a process by which the chemical equilibrium of a waste stream is altered to reduce the solubility of heavy metals. The metals precipitate out as a solid phase and are taken out of the solution by solids removal processes. Metals precipitation is not one unit operation, but a combination of coagulation, flocculation, sedimentation, and filtration processes. Adjustment of pH alone, however, is usually insufficient for removal of the insoluble metal hydroxide solids. Coagulants, such as iron salts, alum, and polymers, must be added to neutralize charges and to cause the formation of metal precipitates. Chemical coagulants are added in a rapid mix tank and are followed by gentle mixing or "flocculation," which causes interlattice bridging and formation of flocs which settle rapidly. The settled solids can then be removed by a clarifier, a filter, or both.

Another consideration for an on-site treatment system is the methodology for discharging the treated effluent. Direct discharge to a receiving stream will require a National Pollutant Discharge Elimination System (NPDES) permit. The effluent standards would be developed on a case-by-case basis depending on the receiving stream. It is premature to speculate on the discharge standards for such an on-site facility, but it is realistic to anticipate stringent effluent standards for organic, inorganic, and secondary water quality parameters. Reinjection or infiltration of the treated effluent into the site aquifer is possible, but as with direct discharge, this option will require stringent effluent cleanup levels.

The feasibility of implementing an on-site treatment alternative is a function of flow rate, leachate quality, discharge methods, cleanup standards, and the effectiveness of the unit processes. Recognizing the low flow rate (assuming half of the total leachate will be collected, 5.7 gpm for No Action, 3.5 gpm for single cap, 0.001 gpm for composite cap) the complexity of the waste matrix (VOCs and inorganics), the anticipated stringent discharge standards, and the fact that a number of the unit operations (e.g., metals removal) are not designed to handle the anticipated low flow rate, on-site treatment of the leachate is not recommended for further consideration.

POTW Disposal

Discharge at a publicly-owned treatment works (POTW) would involve the treatment of the leachate to meet the specific pretreatment requirements for the organic and inorganic contaminants of concern of the receiving POTW. The leachate then would be discharged directly if the local sewer network could accommodate the flow, or transported via tank truck to the receiving POTW facility. The POTW combines the leachate received with its regularly treated wastewater, and the combined treated effluent is discharged to a stream or navigable water. The effluent standards of the POTW are regulated by the facility's NPDES permit. Most POTWs do not accept wastes from Superfund sites. In addition, pre-discharge treatment of leachate would require on-site treatment capabilities. For the Himco site, the municipal wastewater treatment plant closest to the property is the City of Elkhart POTW. The sanitary collection system does not service the area of town where the Himco site is located. Approximately 0.5 mile of sewer and a pump station would have to be constructed. Further, initial conversation with the treatment plant staff (see Appendix A) indicated that leachate would require pretreatment before the POTW would accept this waste. The treatment plant staff further indicated that acceptance of the leachate on a short-term basis (i.e., three to six months) would be acceptable but long-term continuation of such a program would not be acceptable. In contrast to disposal at a TSDF which will require no pretreatment and can proceed indefinitely, discharge to a POTW is not attractive from an implementability perspective. As such, this option is eliminated from further consideration.

TSDF Disposal

Disposal of the collected leachate at a TSDF involves storing the treated leachate on-site and then transporting it to off-site facility via tank truck. No pretreatment of the leachate is required. Based on the limited anticipated volume of leachate to be generated, this process option could be implemented. To a large extent the viability and cost-effectiveness of this option will depend on how many years leachate is generated at this site. This option is retained for further consideration.

2.6 SUMMARY OF REMAINING PROCESS OPTIONS

Based on the evaluation of process options performed in Section 2.5, Table 2-3 presents the process options retained for further consideration and formulation of treatment alternatives in Chapters 3 and 4.

TABLE 2-3

SUMMARY OF REMAINING PROCESS OPTIONS
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

General

- **No Action**

- **Groundwater Monitoring**

- **Institutional Controls**
  Deed Restrictions
  Fencing

Landfill Waste Material

- **Containment of Waste Fill Material**
  Single Barrier Solid Waste Cap
  Composite Barrier Solid Waste Cap

Landfill Gas

- **Collection of Landfill Gas**
  Active Gas Collection

- **Treatment of Landfill Gas**
  Vapor Phase Activated Carbon Adsorption, possibly with enclosed flare unit

Landfill Leachate

- **Collection of Leachate**
  Leachate Extraction Wells

- **Disposal of Leachate**
  Disposal to TSDF

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 INTRODUCTION

In this chapter, technologies and related process options which emerge from the identification and screening of technologies in Chapter 2.0 are combined into alternatives for the total site. These alternatives are carried forward into Chapter 4.0 for detailed analysis. Figure 3-1 presents an overview of the FS screening process.

3.2 DEVELOPMENT OF ALTERNATIVES

Combining technologies to form system alternatives for the entire site is an iterative process which systematically pairs applicable technologies to the defined waste matrices and contaminants of concern. The contaminants of concern include a variety of organic and inorganic contaminants as presented in Chapter 2. The alternatives are developed to present a range of protectiveness and cleanup costs.

Chapter 2 presents ARARs for this site. The alternatives evaluated in the following pages (with the exception of No Action) are developed such that each alternative can attain the ARARs.

The system alternatives developed for this site consist of containment or treatment relative to the landfill contents, leachate and gas matrices. Therefore, in developing total site alternatives, arrays of unit technologies for the landfill waste material, leachate and gas matrices are prepared so that they can be matched to develop the site alternatives.

3.2.1 Landfill Contents

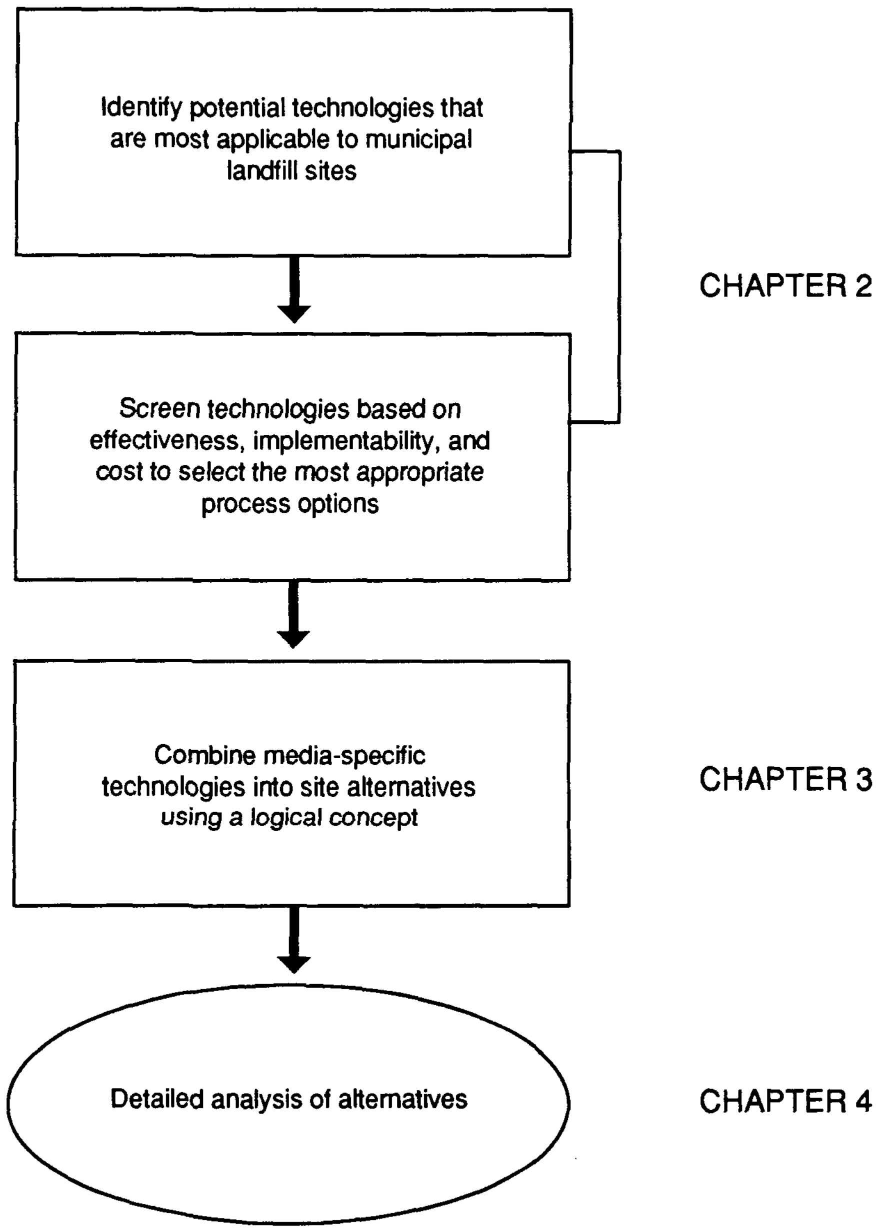
The preliminary alternatives developed for remediation of the landfill material include the following process options:

- The No Action alternative is included as part of the detailed alternatives evaluation in the FS to provide a baseline against which other alternatives may be compared.

- Groundwater monitoring is included to monitor groundwater quality downgradient of the site and to evaluate if the remedy is effective in protecting the site groundwater from adverse impacts by the site contaminants.

FIGURE 3-1
OVERVIEW OF FS SCREENING PROCESS

Himco Dump Superfund Site
Elkhart, Indiana
1992



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- Institutional actions, by means of access restrictions, deed restrictions, and groundwater use restrictions are included as part of each of the alternatives developed for the landfill contents (with the exception of the No Action alternative).

- Containment of waste mass in the landfill, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, with the installation of a single barrier landfill cap.

- Containment of waste mass in the landfill, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, with the installation of a composite (soils and flexible membrane liner (FML)) barrier landfill cap.

3.2.2 Landfill Leachate

The alternatives developed for remediation of the landfill leachate include the following process options:

- Installation of a cap over the site area to reduce the potential for leachate generation. Consideration is given to both single and composite caps for a detailed evaluation in this FS.

- Collection of the leachate at the Himco site with the utilization of multiple extraction wells located in a grid pattern through the landfill waste mass. Collected leachate is directed via an interconnecting piping system to a central collection point. The leachate is then hauled off-site to a licensed TSDF for treatment of the leachate.

3.2.3 Landfill Gas

The alternatives developed for remediation of the landfill gas include the following process options:

- Collection of landfill gas at the Himco site by means of gas collection wells located in a grid network throughout the landfill. The collected landfill gas will be piped to a central point for treatment.

- Treatment of the landfill gas is contingent upon the characteristics of the gas. We are making the assumption based on information from the site that odor control is warranted regardless of the off-gas control technology implemented. Therefore, implementation of a vapor phase, granular, activated carbon system impregnated specifically for odor control is warranted regardless of the system alternative. Thermal treatment as a secondary off-gas control technology will be included only if subsequent gas characterization studies as part of the pre-design phase indicate that thermal treatment is appropriate. If the methane level is low, the need for thermal treatment by means of an enclosed ground flare system may not be necessary.

3.3 SUMMARY

A total of four system alternatives are proposed for detailed evaluation as part of the alternatives evaluation in Chapter 4. Alternative 1, the No Action alternative, is carried forward as a baseline for comparison to other alternatives. Inclusion of the No Action alternative is mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA). The calculated baseline risk for the Himco site is 6 in 10,000 (6E-4), which is associated with the carcinogenic contaminants for a hypothetical adult resident on the landfill. The noncarcinogenic risk for the same population is 70 times the acceptable levels.

Alternative 2 is the construction of a single barrier clay cap with the inclusion of an active LFG collection system. The off-gas from the landfill is treated by means of a vapor phase carbon system, with an enclosed ground flare to be implemented if subsequent landfill gas characterization studies indicate the need to burn the methane generated. This alternative does not include provisions for collecting and treating the leachate from this site. Groundwater monitoring and institutional controls are included as part of Alternative 2.

Alternative 3 is identical to Alternative 2 presented above. The distinguishing feature of this alternative is that leachate collection and treatment is included. The leachate is proposed to be collected by means of an elaborate system of pneumatic air injection wells placed in a grid pattern across the site. The collected leachate would be hauled to an off-site licensed TSDF for treatment.

Alternative 4 is the same as Alternative 2, but uses a composite cap over the site. As in Alternative 2, this alternative does not include provisions for collection and treatment of the leachate.

These alternatives are assembled in Figure 3-2.

FIGURE 3-2
ASSEMBLED REMEDIAL ALTERNATIVES
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

ALTERNATIVE DESCRIPTION	SITE	GROUNDWATER	LANDFILL WASTE MATERIAL		LANDFILL LEACHATE	LANDFILL GAS
			Single Barrier Cap	Composite Barrier Cap		
1 No Action						
2 Containment w/ Single Barrier Cap Active Gas Collection and Treatment Groundwater Monitoring Institutional Controls	Institutional Controls	Groundwater Monitoring	Single Barrier Cap			Active Gas Collection and TSDF
3 Containment w/ Single Barrier Cap Leachate Collection and Off-site Treatment Active Gas Collection and Treatment Groundwater Monitoring Institutional Controls	Institutional Controls	Groundwater Monitoring	Single Barrier Cap		Leachate Collection and TSDF	Active Gas Collection and TSDF
4 Containment w/ Composite Barrier Cap Active Gas Collection and Treatment Groundwater Monitoring Institutional Controls	Institutional Controls	Groundwater Monitoring		Composite Barrier Cap		Active Gas Collection and TSDF

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 DESCRIPTION OF EVALUATION CRITERIA

In this chapter, the alternatives which were developed in Chapter 3 are evaluated and compared to each other using nine evaluation criteria to present a range of site alternatives from which a remedy can be selected.

The detailed evaluation addresses the nine criteria listed below:

1. Overall protection of human health and the environment
2. Compliance with applicable and/or relevant and appropriate requirements (ARARs)
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, and volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

Each of these nine criteria is presented in Figure 4-1 and summarized briefly below. Figure 4-1 also shows the nine criteria grouped in three categories: threshold criteria, balancing criteria, and modifying criteria.

4.1.1 Overall Protection of Human Health and the Environment

This criterion is categorized as a threshold criterion, i.e., alternatives must pass this criterion to remain in the evaluation. This criterion assesses the protection afforded by each alternative, considering long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. Protection of human health is assessed by evaluating how site risks from each exposure pathway are eliminated, reduced, or controlled through the specific alternative. This evaluation takes into account short-term or cross-media impacts that result from remedial activity.

4.1.2 Compliance with ARARs

This criterion is also a threshold criterion: all alternatives must achieve compliance with state and federal ARARs to be considered as a site remedy, or, if compliance is not achieved, a justifiable ARAR waiver must be obtained. Section 121(d) of SARA mandates that, for all remedial actions conducted under CERCLA, cleanup activities must be conducted in a manner that complies with ARARs. The NCP and SARA have defined both applicable requirements and relevant and appropriate requirements as follows:

FIGURE 4-1
CRITERIA FOR DETAILED ANALYSIS OF ALTERNATIVES

Himco Dump Superfund Site
Elkhart, Indiana
1992

THRESHOLD CRITERIA:

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

- How alternative provides human health and environmental protection

COMPLIANCE WITH ARARs

- Compliance with chemical-specific ARARs
- Compliance with location-specific ARARs
- Compliance with action-specific ARARs
- Compliance with other criteria, advisories, and guidances

BALANCING CRITERIA:

LONG-TERM EFFECTIVENESS AND PERMANENCE

- Magnitude of residual risk
- Adequacy and reliability of controls

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

- Treatment process used and materials treated
- Amount of hazardous materials destroyed or treated
- Degree of expected reductions in toxicity, mobility, and volume
- Degree to which treatment is irreversible
- Type and quantity of residuals remaining after treatment

SHORT-TERM EFFECTIVENESS

- Protection of community during remedial actions
- Protection of workers during remedial actions
- Environmental impacts
- Time until remedial action objectives are achieved

IMPLEMENTABILITY

- Ability to construct, operate and maintain the technology
- Reliability of the technology
- Ease of undertaking additional remedial actions, if necessary
- Ability to monitor effectiveness of remedy
- Ability to obtain approvals from other agencies
- Coordination with other agencies
- Availability and capacity of off-site treatment, storage, and disposal services
- Availability of necessary equipment and specialists
- Availability of prospective technologies

COST

- Capital costs
- Operating and maintenance costs
- Present worth costs

MODIFYING CRITERIA:

STATE ACCEPTANCE[1]

COMMUNITY ACCEPTANCE[1]

Notes:
ARARs Applicable or relevant and appropriate requirements.
[1]Evaluated after public comment period

(EPA, 1988)

Mac/Himco/Tech Figs/012992/4-1

- Applicable requirements are those federal and state requirements that are legally applicable, either directly or as incorporated by a federally authorized state program, if the response action were not undertaken pursuant to Section 104 or 106 under CERCLA.

- Relevant and appropriate requirements are those federal and state requirements that, while not legally "applicable," are designed to apply to problems sufficiently similar to those encountered at CERCLA sites that their application is appropriate. Requirements may be relevant and appropriate if they would otherwise be "applicable" but for jurisdictional restrictions associated with the requirement.

- Other requirements to be considered are federal and state non-regulatory requirements, such as guidance documents or criteria. Advisories or guidance documents do not have the status of potential ARARs. However, where there are no specific ARARs for a chemical or situation, or where such ARARs are not sufficient to be protective, guidance or advisories are identified and used to ensure that a remedy is protective.

Many federal and state ARARs are considered under the description of ARARs set forth in the NCP and SARA. These requirements include ARARs that are:

- Chemical-specific
- Location-specific
- Action-specific

Chemical-specific ARARs govern the extent of site cleanup in terms of actual cleanup levels. Location-specific ARARs govern natural site features such as wetlands and floodplains, and human-made features such as existing landfill and disposal areas. Action-specific ARARs are technology- or activity-based requirements that set restrictions on particular kinds of actions at CERCLA sites.

A summary of ARARs for the Himco site is included in Section 4.4.2. Compliance or noncompliance with these ARARs are evaluated for each alternative. If an alternative does not comply with the requirements, justifications for a waiver must be presented.

4.1.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence is one of five criteria considered as balancing criteria. These criteria are used to weigh the positive and negative aspects of performance, implementability, and cost of each alternative.

The focus of evaluating long-term effectiveness and permanence is to determine the extent and effectiveness of each alternative with respect to the risk posed by residuals and/or untreated wastes after the cleanup criteria have been reached. Components of this criterion include the following:

- Magnitude of residual risk from the alternative
- Likelihood that the alternative will meet process efficiencies and performance specifications
- Adequacy and reliability of long-term management controls providing continued protection from residuals

4.1.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

Reduction of toxicity, mobility, and volume through treatment is a principal statutory requirement of CERCLA. This analysis evaluates the quantity of contaminants treated and destroyed; the degree of reduction in contaminant toxicity, mobility, or volume; the degree to which the treatment is irreversible; the type and quantity of residuals remaining; and how the principal threat is addressed through treatment. The risk posed by residuals is likewise considered in determining the adequacy of each alternative for this criterion.

4.1.5 Short-Term Effectiveness

The short-term effectiveness of each alternative is assessed based on the risk associated with the remedial action to the community, workers, environment during implementation of the remedial action, and the time required to achieve the response objectives. Mitigation measures to provide protection are a key issue in this determination.

4.1.6 Implementability

This criterion analyzes technical feasibility, administrative feasibility, and availability of services and materials. Technical feasibility assesses the difficulty of construction or operation of a particular alternative and the unknowns associated with a technology. The reliability of the technology based on the likelihood of technical problems that would lead to project delays is important in this determination. The ability to monitor the effectiveness of the alternative is also considered. Finally, the risk of exposure should the monitoring plan not detect a system failure is evaluated to assess a worst-case scenario.

Administrative feasibility assesses the ease or difficulty of obtaining permits or rights-of-way for construction.

Availability of services, materials, and off-site treatment, storage, and disposal services are evaluated. Necessary equipment, specialists, and additional resources are also evaluated in determining the ease by which these needs can be fulfilled. The potential for obtaining competitive bids is also evaluated for each technology or service.

4.1.7 Cost

The total cost of each alternative is developed based on the sum of the direct capital costs (materials, equipment, labor), indirect capital costs (engineering, contingencies, licenses, permits), and operation and maintenance (O&M) costs. Present worth costs are also developed for each alternative to provide a common basis for comparing substantially different alternatives. Costs are evaluated using a sensitivity analysis after the present worth analyses are completed. The sensitivity analysis evaluates the effects of uncertainties related to site or technology characteristics.

4.1.8 State Acceptance

This criterion evaluates the technical and administrative issues that may be raised by IDEM. This criterion is assessed after comments are received on the RI/FS and Proposed Plan.

4.1.9 Community Acceptance

This criterion evaluates concerns from members of the community related to the alternatives. This criterion is assessed after comments are received on the FS and Proposed Plan.

4.2 GENERAL SITE ELEMENTS

Before evaluating the four remedial alternatives presented in Section 4.3, general elements common to Alternatives 2 through 4 are discussed. These common elements include:

- Groundwater monitoring
- Institutional controls
- LFG collection and treatment

The No Action alternative, Alternative 1, does not include the common elements described in this chapter.

The RI data indicate that groundwater has not been impacted to a level of health and environmental concern by the site contaminants. This evaluation has been made based on the results of the groundwater chemical analyses as well as baseline risk assessment. However, groundwater monitoring has been incorporated in all alternatives, except the No Action alternative, to evaluate the effectiveness of the selected alternative. If groundwater monitoring shows that the selected alternative is not working, a groundwater study would be warranted. Based on the groundwater study, appropriate remedial measures may be required to protect the site groundwater. In order to ensure reliable groundwater monitoring, additional monitoring wells will be installed downgradient of the site. Data from these wells and existing wells will be used to evaluate the future groundwater condition. These samples will be analyzed for target compound list (TCL) VOCs and target analyte list (TAL) metals.

The FS proposes a preliminary monitoring program for future groundwater monitoring at this site. The preliminary monitoring program has been developed for cost development purposes; the final monitoring program, including the number and locations of the monitoring wells, will be developed as a part of the pre-design/design phase of the project. The groundwater monitoring program will be implemented as a part of the remedial action at this site. According to the preliminary program, 19 groundwater monitoring wells (including the background monitoring wells) will be sampled two times per year. Appendix A presents the proposed preliminary monitoring program.

Institutional controls are necessary to restrict access to the Himco site for present and future uses. Access restrictions include fencing the landfill and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill (the area to be capped) to limit unauthorized access for recreation and other uses, and deed restrictions to limit future building of residences or commercial enterprises on the site. Institutional controls also include restrictions on pumping from the aquifer in the site vicinity to ensure that leachate from the landfill would not be drawn to the pumping well. Appendix A presents a discussion relative to the zone of influence under various pumping conditions for the purpose of implementing institutional controls for groundwater use at this site.

LFG collection and treatment is assumed to include an active gas collection system and vapor phase carbon adsorption for VOC emission and odor control. As discussed in Chapters 2 and 3, the quantity and quality of the LFG is uncertain at this time. However, it is assumed that regardless of the system alternative, off-gas treatment for odor control is required as a minimum. As discussed in Chapter 3, active gas collection systems are assumed for all of the alternatives evaluated. Figure 4-2 presents a schematic of the proposed gas collection system.

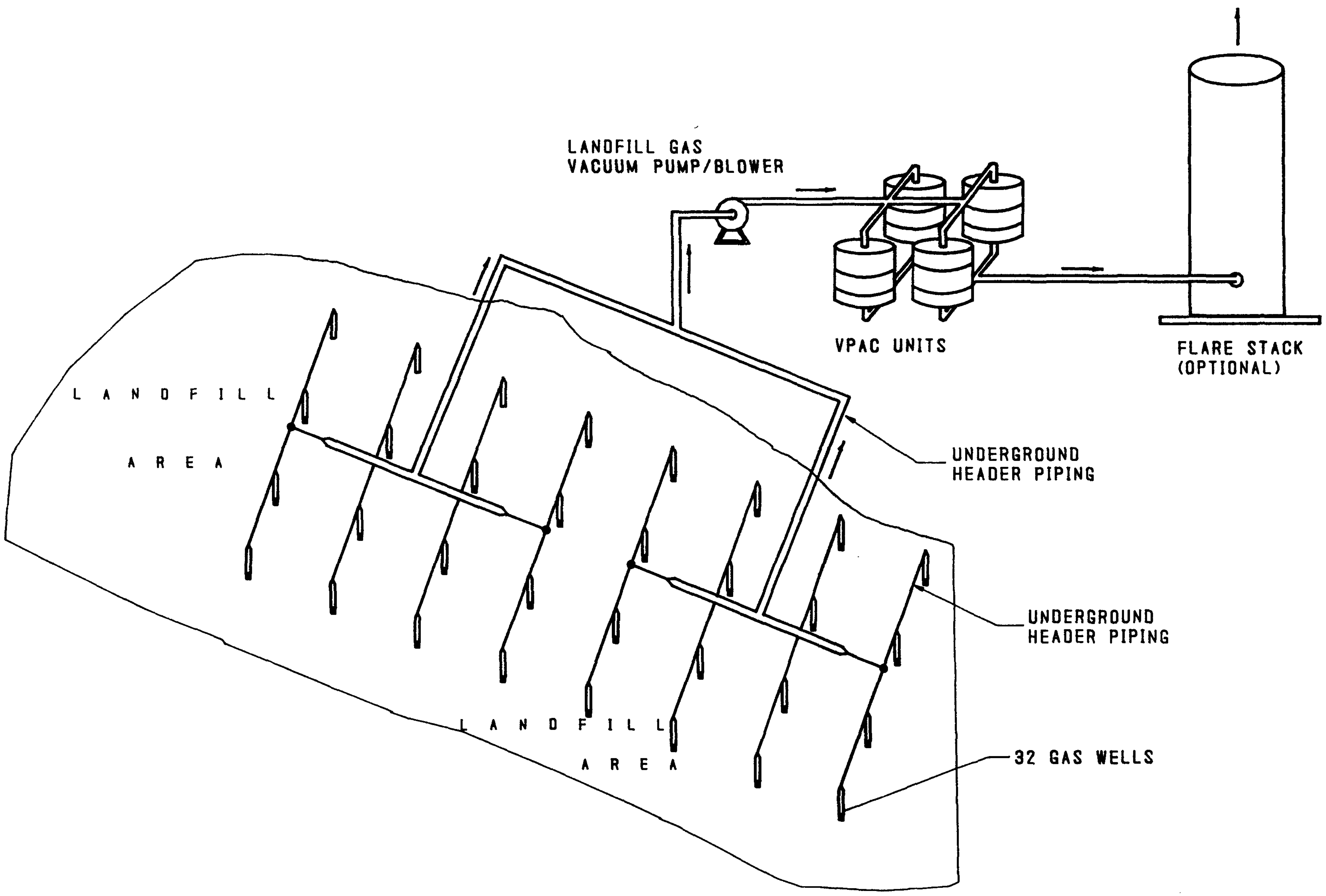


FIGURE 4-2
ACTIVE GAS COLLECTION
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

Donohue ENGINEERS ARCHITECTS SCIENTISTS

Scale	AS SHOWN
Date	NOV. 1991
Designer	SP
Drafter	EZ
Checker	
Approver	

Drawing No. 4-2

Treatment of the off-gas is contingent on the quality of the LFG. Odor control warrants the use of specially impregnated carbon adsorption or the use of more sophisticated off-gas scrubber systems. If the methane content is significant (above the lower explosive limit or LEL), inclusion of an enclosed, ground flare system for thermal oxidation of the methane would be necessary. The spent carbon may become a characteristic waste and should be tested to TCLP before disposal. Detailed characterization of the LFG will be included as part of subsequent predesign investigations and the necessity for thermal treatment clearly defined. At this point, thermal treatment is not assumed as part of the initial off-gas treatment train but will be included if subsequent LFG characterization reveals methane levels approaching the LEL.

4.3 INDIVIDUAL ANALYSIS OF ALTERNATIVES

This section describes the selected remediation alternatives and compares the alternatives against the evaluation criteria described in Section 4.1.

4.3.1 Alternative 1 - No Action

The No Action alternative does not provide for removal, treatment, or containment of the landfill waste mass, leachate, or gas; therefore, the potential for contaminant releases or exposure to contaminants which affect human and environmental receptors continues to exist. The estimated infiltration under this alternative is 4.6 inches/year or approximately 6 million gallons per year. This alternative is included as a SARA requirement to provide a baseline against which other alternatives may be compared.

The lifetime excess cancer risk due to soil ingestion associated with the No Action alternative for a hypothetical future resident on the landfill is two in 10 (2E-1). The noncarcinogenic risk for the same population is 700 times the accepted level (HI of 7E+2). This risk is primarily a result of human exposure to the landfill leachate.

The No Action alternative does not satisfy or comply with current federal and state ARARs; it does not provide any long-term effectiveness and permanence; it does not provide a reduction of toxicity, mobility, or volume through its implementation; and it has no capital cost, and annual operation and maintenance cost.

According to EPA's new policy, common elements of groundwater monitoring and access restrictions are not considered nor included as part of the No Action alternative. As shown in Table 4-1, the cost for this alternative is $0.00.

TABLE 4-1
COST FOR ALTERNATIVE 1 - NO ACTION
CAPITAL AND O&M COST
Himco Dump Superfund Site
Elkhart, Indiana

I.	CAPITAL COST	$0

No capital costs associated with this alternative.

II.	ANNUAL O&M COST	$0

No operation and maintenance costs associated with this alternative.

4.3.2 Alternative 2 - Containment by Means of a Single Barrier, Solid Waste Cap; Active Landfill Gas Collection and Treatment; Groundwater Monitoring; and Institutional Controls

4.3.2.1 Description

Alternative 2 includes a single barrier, solid waste cap to contain the landfill waste mass and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, and an active landfill gas collection and treatment system with a vapor phase carbon adsorption (Figure 4-2). Additionally, this alternative is coupled with groundwater monitoring and institutional controls. The primary components of this alternative include the following:

- Construct a single barrier, solid waste cap with a total area equal to approximately 58 acres.

- Install an active landfill gas collection system to remove LFGs generated in the landfill waste mass, and vent this gas to the atmosphere after treatment with vapor phase activated carbon to remove VOCs and control odor; and if necessary, construct a thermal oxidation process with a flare stack to destroy methane.

- Establish a groundwater monitoring program to evaluate the effectiveness of the selected alternatives.

- Implement institutional controls which include installation of a fence around the landfill and contaminated soils covered by the cap, and deed restrictions limiting the site's future land use as well as restriction on groundwater use in the site vicinity.

<u>Treatment Components</u>

The treatment component associated with this alternative is the use of vapor phase activated carbon to remove VOCs from the landfill gas.

<u>Containment Components</u>

The entire landfill waste mass and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill will be contained beneath the single barrier, solid waste cap as part of Alternative 2. General site preparation and layout will be completed to re-route surface water drainage away from the capped area. The cap will consist of an 18-inch vegetated soil layer, a 6-inch sand drainage layer, and a 2-foot thick, low permeability clay layer. The vegetative soil layer will be seeded, if possible, with the current on-site plant species to preserve the uniqueness of the prairie assemblage at this site. However, consideration should be given to potential problems associated with the burrowing animals and deep rooting plants before this option is selected as the surface vegetation for this site. Also, the cap will be designed to minimize any adverse impact to the wetland delineated during the RI. In the design of the cap, consideration will be given to maintaining the current water balance at the wetland. An additional layer of soil (buffer) will be laid over the existing landfill to attain the State of Indiana required 4 percent grade and to facilitate surface drainage over the single barrier cap. Although not included in the preliminary site layout as part of this FS, it may be appropriate to obtain a waiver from IDEM to allow slopes of less than 4 percent which would minimize the extent of the buffer zone and reduce the capital cost.

4.3.2.2 Overall Protection of Human Health and the Environment

Implementing this option significantly reduces the potential risk to human health and the environment. Although the landfill waste, leachate, and contaminated soils are not treated by this alternative, capping the site theoretically eliminates the primary exposure pathway and thereby eliminates the risk to the potential receptors. Capping also reduces the rate of leachate generation in the landfill and therefore, minimizes potential for adverse impacts to groundwater by the site contaminants. The estimated leachate generation rate under this alternative is 2.9 inches/year or 3.7 million gallons per year.

4.3.2.3 Compliance with ARARs

ARARs pertinent to Alternative 2 include both federal and state environmental regulations that have been enacted to protect and enhance air quality.

Federal:

20 CFR	Worker Protection
40 CFR 6	Protection of Wetlands
40 CFR 52	Approval and Promulgation of State Implementation Plans
40 CFR 122	National Pollutant Discharge Elimination System (NPDES)
40 CFR 264	Standards for Owners and Operator of Hazardous Waste Treatment Storage and Disposal Facilities

Indiana:

326 IAC 1-3	Ambient Air Quality Standards
326 IAC 2	Facility Construction
326 IAC 6-4	Particulate Matter Emissions
326 IAC 8-1-6	VOC Emissions
329 IAC 2-4, 2-14, 2-44, 3-53.5A	Final Cover, Solid Waste Landfill

Landfill Cap Construction ARARs

Dust from the construction of the cap could represent a potential pollutant pathway at this site. Federal ARARs empower states to regulate total suspended particulate (TSP) emission. Indiana regulations require that particulate matter emissions be controlled so that there would be no visible release of emissions off-site. Indiana has established primary and secondary ambient air quality standards necessary to protect human health and welfare.

Landfill Gas Collection ARARs

Federal regulations (40 CFR 52.770-797) require the filing of an Air Pollution Emission Notice (APEN) with the state to include an estimation of emission rate for each expected pollutant. Information to be filed with the APEN includes:

- Modeled impact analysis of emissions
- Demonstration of the use of Best Available Control Technology (BACT)
- A prediction of total emissions of VOCs to demonstrate that VOC emissions do not exceed the allowable emission levels using Reasonably Available Control Technology (RACT)

Indiana regulations have established limits for VOC emissions from new sources (25 tons per year). Because Elkhart County is a non-attainment area for ozone, IDEM may require very stringent criteria for VOC emissions in the Elkhart County area. Indiana requires BACT for new sources with potential VOC emissions of 25 tons per year or greater. The applicability of this ARAR will need to be established after installation of the gas collection system by field measurement of off-gas from the system.

4.3.2.4 Long-Term Effectiveness and Permanence

A single barrier, solid waste cap theoretically eliminates dermal contact, ingestion, and inhalation exposure pathways to the contaminants in the landfill and the construction debris area, thus eliminating the associated risk with these pathways. The 2-foot thick layer of compacted clay provides a good barrier against infiltration of rainwater and covers the landfill waste mass and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill.

The solid waste cap also reduces the infiltration of rainwater into and through the waste fill mass, which reduces leachate generation and minimizes the potential for contamination of the aquifer.

A five-year review is required under CERCLA Section 121c, which states that any remedial action resulting in hazardous substances, pollutants, or contaminants remaining on-site must be reviewed at least once every five years. This review should be conducted to determine whether public health and the environment continue to be protected by the remedial action. Additional action may be necessitated by this review.

The cap and the gas collection system will need to be maintained regularly to assure their integrity and long-term effectiveness and permanence as a remedial alternative. Additionally, access restrictions are required to maintain the cap's integrity and long-term effectiveness and permanence. Long-term maintenance of the cap includes replacement of the cap material, compaction, seeding, and fertilization. In addition, erosion and drainage control measures and repair or replacement of the perimeter fence may also be required. Long-term maintenance of the gas collection system includes replacement/repair of the landfill gas extraction wells and the interconnecting piping system. Routine replacement or regeneration of the carbon adsorption units is also required.

If repair of the cap or the gas collection system is required, their repair or replacement are easily accomplished, similar to their original construction. The primary concern is to prevent emission of airborne dust from the landfill and to prevent exposure to leachate during repair work on the cap. In the areas where the gas collection wells and interconnecting piping is buried under the cap, exposure to the waste mass and leachate would be a potential concern. Breached areas would remain a risk until the cap is repaired/replaced.

4.3.2.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

Installation of a single barrier solid waste cap is a form of containment; therefore, in practical sense, there would be no reduction in toxicity or volume through treatment. There would be a slight reduction in toxicity and volume due to the removal and treatment of the landfill gas. This cap would reduce the infiltration of rainwater into the landfill, thereby reducing the rate of leachate generation in the landfill and reducing the mobility of contaminants present in the waste mass.

4.3.2.6 Short-Term Effectiveness

Potential risks to the community during the implementation of this remedial alternative are from exposure to airborne dust and organic vapors from the waste mass and leachate. Workers employed in the construction of the gas collection system and the cap may be exposed to the waste mass and leachate material. Dust control by spraying water on the construction area would minimize fugitive dust generation. Proper protective equipment should be worn by site workers to reduce exposure to contaminated soils and organic vapors. Before beginning work on the site, the contractor must prepare a Health and Safety Plan, which in part addresses the appropriate personal protective equipment necessary for working on this site.

4.3.2.7 Implementability

Implementation of the single barrier, solid waste cap with a gas collection system is not perceived to be difficult. The gas collection system would be installed subsequent to the construction of the additional soil layer (buffer), followed by construction of the clay, drainage, and vegetative layer. With a proper construction sequence, intrusive actions will be kept to a minimum level. With this alternative, monitoring effectiveness and administrative feasibility are readily implementable. It is relatively easy to do additional actions, and services and materials are readily available.

4.3.2.8 Cost

The estimated capital cost is $7,539,000. The estimated annual operation and maintenance cost is $210,000. The estimated total present worth cost is $10,429,000. This cost includes groundwater monitoring for 30 years, a five-year review, and general maintenance of the cap's integrity.

Costs for Alternative 2 are summarized in Table 4-2, and detailed cost calculations and assumptions are presented in Appendix B.

4.3.3 Alternative 3 - Containment by Means of a Single Barrier, Solid Waste Cap; Active Landfill Gas Collection and Treatment; Leachate Collection and Off-Site TSDF Disposal; Groundwater Monitoring; and Institutional Controls

4.3.3.1 Description

Alternative 3, like Alternative 2, uses containment by means of a single barrier, solid waste cap to contain the waste mass. This alternative also includes a leachate collection system for the extraction of leachate in the landfill. The primary components of this alternative include the following:

TABLE 4-2
COST FOR ALTERNATIVE 2 – SINGLE BARRIER CAP, ACTIVE GAS COLLECTION & TREATMENT, GROUNDWATER MONITORING, & INSTITUTIONAL CONTROL CAPITAL AND O&M COST
Himco Dump Superfund Site
Elkhart, Indiana

I.	CAPITAL COST		
	A.	Institutional Control and Groundwater Monitoring	$71,000
	B.	Single Barrier Solid Waste Cap	$5,121,000
	C.	Active Gas Collection & Treatment	$271,000
	SUBTOTAL CAPITAL COST		$5,463,000
		Engineering (10%)	$546,300
		Construction Oversight (3%)	$163,890
		Contingencies (25%)	$1,365,750
	TOTAL CAPITAL COST		$7,539,000
II.	ANNUAL O&M COST		
	A.	Institutional Control and Groundwater Monitoring	$88,000
	B.	Single Barrier Solid Waste Cap	$64,000
	C.	Active Gas Collection & Treatment	$58,000
	TOTAL ANNUAL O&M COST		$210,000
III.	PRESENT WORTH 30-YEAR O&M COST		$2,890,000
IV.	TOTAL PRESENT WORTH COST		$10,429,000

- Construct a single barrier, solid waste cap with a total area equal to approximately 58 acres.

- Install an active landfill gas collection system to remove LFG generated within the landfill waste mass, and vent this gas to the atmosphere after treatment with vapor phase activated carbon to remove VOCs, and flare stack to destroy methane, if necessary. Figure 4-2 presents a schematic of the proposed gas collection system.

- Install a leachate collection system consisting of vertical wells in the landfill to extract leachate generated in the landfill. The collected leachate would be transported to a TSDF for treatment and disposal. Figure 4-3 presents a schematic of the proposed leachate collection system.

- Establish a groundwater monitoring program to evaluate the effectiveness of the selected alternatives.

- Implement institutional controls which include installation of a fence around the landfill and contaminated soils covered by the cap, and deed restrictions limiting the site's future land use, as well as restriction on groundwater use in the site vicinity.

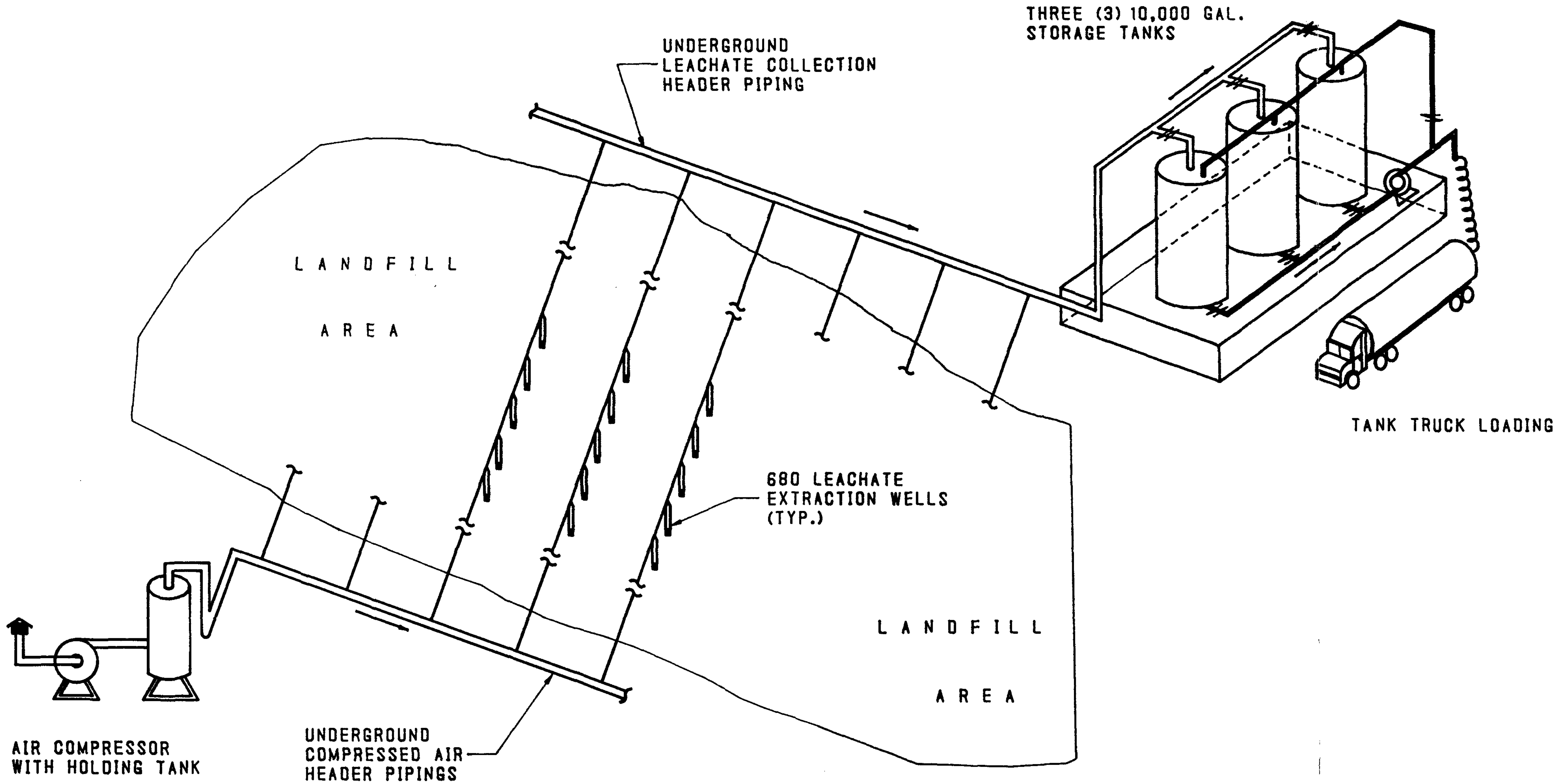
<u>Treatment Components</u>

Similar to Alternative 2, the treatment component associated with with Alternative 3 includes the use of vapor phase activated carbon to remove VOCs from the LFG. An active collection system is prescribed to direct the LFG to individual vents for treatment and discharge.

Leachate collected from the landfill waste mass will be stored on-site for shipment off-site to a TSDF capable of handling this waste stream. A leachate collection system is prescribed to extract the leachate from the landfill and to direct it to a central location point for storage.

<u>Containment Components</u>

The contaminant component for Alternative 3 is similar to Alternative 2.



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Designer	SP
Drafter	EZ
Checker	
Approver	

No.	Revisions	By	Date

Donohue ENGINEERS ARCHITECTS SCIENTISTS

FIGURE 4-3
LEACHATE COLLECTION
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA

Sheet No.
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Project No.
Drawing No. 4-3

FIG4_3.DGN LEVEL 3

4.3.3.2 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment for Alternative 3 is similar to Alternative 2. However, Alternative 3 provides an added level of protection by removing and treating leachate from the landfill. As part of this alternative, 680 leachate extraction wells (see Appendix A) will be installed and pumped perpetually. Collection of the generated leachate in the landfill will minimize the potential release of leachate into the groundwater and/or to the environment outside of the landfill boundaries, thereby minimizing potential for adverse impacts to groundwater by the site contaminants. It should be noted that the RI data do not indicate that groundwater outside of the landfill boundary is currently impacted by the site contaminants. Furthermore, it is expected that construction of a solid waste cap will reduce the leachate generation rate in the landfill, which will provide a significant improvement over the current (No Action) condition. Although this improvement can be conceptualized, in view of the current no-impact groundwater condition, the risk-based added level of protection to groundwater provided by the leachate collection at this site is theoretically null.

4.3.3.3 Compliance with ARARs

ARARs pertinent to Alternative 3 include those identified for Alternative 2 with the addition of those ARARs relevant to the extraction and off-site disposal of landfill leachate at a TSDF.

4.3.3.4 Long-Term Effectiveness and Permanence

Alternative 3, like Alternative 2, incorporates a single barrier, solid waste cap and active gas collection system. As such, the discussion presented in Section 4.3.2.4 for long-term effectiveness and permanence also applies to Alternative 3.

Leachate collection provides greater protection to human health and the environment by removing contaminated leachate from the landfill area. Because groundwater is hydraulically connected with the landfill waste, there is uncertainty as to the effectiveness of vertical leachate wells to collect the leachate.

4.3.3.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 3 incorporates a single barrier, solid waste cap for containment of the landfill mass; therefore, in a practical sense, there would be no reduction in toxicity and volume by this process option. Because of the removal and treatment of the landfill gas, there would be a slight reduction in toxicity and volume due to VOCs removal. There would be reduction in mobility because less leachate would be generated in the landfill due to the inclusion of the cap. Alternative 3 incorporates a leachate collection system, which marginally reduces toxicity and further reduces mobility of the contaminants by removing and treating leachate from the landfill.

4.3.3.6 Short-Term Effectiveness

Short-term effectiveness of this alternative is similar to Alternative 2. Additionally, because this alternative incorporates a leachate collection system, workers installing the leachate collection system may be exposed to the landfill waste and leachate. However, this risk may be alleviated by following health and safety requirements to be developed for this activity.

4.3.3.7 Implementability

Alternative 3, like Alternative 2, incorporates a single barrier cap and active gas collection system. As such, discussion presented in Section 4.3.2.7 for the implementability for Alternative 2 applies to Alternative 3, as well. Alternative 3 also incorporates a leachate collection system. Because it is estimated that 680 leachate wells would be required for this site to effectively collect the generated leachate, it is expected that construction of these wells with interconnecting pipes, pumping systems, electrical and mechanical control, would be very complex. In short, the implementability of the groundwater extraction component of this alternative is questionable from an implementation perspective.

4.3.3.8 Cost

The estimated capital cost for the implementation of institutional components and the purchase and installation of the treatment component of this alternative is $13,628,000. It is notable that the leachate collection system to generate a total flow rate of 3.5 gpm (assuming half of the total leachate volume would be collected by the leachate collection system) is projected to cost $4,412,000 for installation (capital cost).

The estimated annual operation and maintenance costs associated with the institutional, treatment, and disposal components of Alternative 3 are $982,000 over the expected duration of the alternative's remediation effort. The total present worth cost is estimated at $27,140,000. The present worth cost is based on 24 hours per day and 365 days per year operation of the leachate extraction system, and 30 years of groundwater monitoring.

Costs for Alternative 3 are summarized in Table 4-3, and detailed cost calculations and assumptions are presented in Appendix B.

4.3.4 Alternative 4 - Containment by Means of a Composite Barrier, Solid Waste Cap; *Active Collection and Treatment of Landfill Gas; Groundwater Monitoring; and* Institutional Controls

4.3.4.1 Description

Alternative 4 includes a composite barrier, solid waste cap to contain the landfill waste mass and an active landfill gas collection and treatment with vapor phase carbon adsorption, groundwater monitoring, and institutional controls. The primary components of this alternative include the following:

- Construct a composite barrier, solid waste cap with a total area equal to approximately 58 acres.

- Install an active, landfill gas collection system to remove LFG generated within the landfill waste mass, and vent this gas to the atmosphere after treatment with vapor phase activated carbon to remove VOCs, and possibly with a flare stack to remove methane, if necessary.

- Establish a groundwater monitoring program to evaluate the effectivenss of the selected alternatives.

- Implement institutional controls which include installation of a fence around the landfill and contaminated soils covered by the cap, and deed restrictions limiting the site future land use, as well as restriction on groundwater use in the site vicinity.

<u>Treatment Components</u>

The treatment component for this alternative is similar to Alternative 2.

TABLE 4–3
COST FOR ALTERNATIVE 3 – SINGLE BARRIER CAP,
ACTIVE GAS COLLECTION & TREATMENT,
LEACHATE COLLECTION SYSTEM,
GROUNDWATER MONITORING, & INSTITUTIONAL CONTROL
CAPITAL AND O&M COST
Himco Dump Superfund Site
Elkhart, Indiana

I.	CAPITAL COST	
	A. Institutional Control and Groundwater Monitoring	$71,000
	B. Single Barrier Cap	$5,121,000
	C. Active Gas Collection & Treatment	$271,000
	D. Leachate Collection System	$4,412,000
	SUBTOTAL CAPITAL COST	$9,875,000
	Engineering (10%)	$987,500
	Construction Oversight (3%)	$296,250
	Contingencies (25%)	$2,468,750
	TOTAL CAPITAL COST	$13,628,000
II.	ANNUAL O&M COST	
	A. Institutional Control and Groundwater Monitoring	$88,000
	B. Single Barrier Cap	$64,000
	C. Active Gas Collection & Treatment	$58,000
	D. Leachate Collection System	$772,000
	TOTAL ANNUAL O&M COST	$982,000
III.	PRESENT WORTH 30–YEAR O&M COST	$13,512,000
IV.	TOTAL PRESENT WORTH COST	$27,140,000

Containment Components

The entire landfill waste mass and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, will be contained beneath a composite barrier, solid waste cap as part of Alternative 4. General site preparation and layout will be completed to re-route surface water drainage away from the capped area. The composite layer cap will consist of an 18-inch vegetated soil layer, a 6-inch sand drainage layer, a 40 mil high density polyethylene (HDPE) liner, and a 2-foot thick clay layer. The vegetative soil layer will be seeded, if possible, with the current on-site plant species to protect the uniqueness of the prairie assemblage at this site. Additionally, a layer of soil (buffer) will be placed over the existing landfill to attain the required 4 percent grade, and to facilitate surface drainage over the composite barrier cap. Similar to the construction of the single cap, the composite cap will be designed to minimize any adverse impact to the wetland delineated during the RI.

4.3.4.2 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment for Alternative 4 is similar to Alternative 2. The estimated leachate generation rate under this alternative is 0.001-inch per year or 1,000 gallons per year. However, Alternative 4 provides an added level of protection by reducing the infiltration rate into the landfill. Reducing infiltration into the landfill will minimize the potential release of leachate into the groundwater and to the environment outside of the landfill boundaries, thereby minimizing potentials for adverse impacts to human health and the environment. It should be noted that the RI data do not indicate that groundwater outside of the landfill boundaries is currently impacted by the site contaminants. In view of the current no-impact condition, the risk-based added level of protection to groundwater provided by the leachate collection at this site cannot be theoretically calculated.

4.3.4.3 Compliance with ARARs

ARARs pertinent to Alternative 4 parallel those identified for Alternative 2.

4.3.4.4 Long-Term Effectiveness and Permanence

A composite barrier, solid waste cap--similar to the single barrier, solid waste cap--theoretically eliminates dermal contact, ingestion, and inhalation exposure pathways to the contaminants in the landfill, thus eliminating the risks associated with these pathways. Thus, the discussion presented in Section 4.3.2.4 for long-term effectiveness and permanence for Alternative 2 applies to Alternative 4 as well. Inclusion of an HDPE liner provides greater protection to human health and the environment by minimizing release of leachate into the groundwater and/or to the environment outside of the landfill boundaries.

4.3.4.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 4 incorporates a composite cap for containment of the landfill waste; therefore, in terms of reduction of toxicity, mobility, and volume, it is similar to Alternatives 2 and 3. Alternative 4 incorporates a liner system which reduces the leachate generator rate; this further reduces mobility of contaminants in the landfill.

4.3.4.6 Short-Term Effectiveness

Short-term effectiveness of this alternative is similar to Alternative 2.

4.3.4.7 Implementability

Alternative 4 incorporates a composite barrier cap which includes all elements of a single barrier cap with addition of a geomembrane liner above the clay cap. Geomembrane technology has been well developed in the the past 10 years; therefore, implementation of a composite barrier cap is not perceived to be difficult. The construction sequence for this alternative is more important than other alternatives which do not include a geomembrane liner. Once the geomembrane liner is installed, there should not be any intrusive action to cause abrasion or incision of the liner. The gas collection system should be installed subsequent to the construction of the additional soil (buffer) layer, followed by construction of the composite cap.

The biggest difficulty associated with this alternative is performing repair work on the gas collection system. This task may require removal/cutting of the geomembrane liner to gain access to the gas wells or the feeder pipes. For these reasons, design process for the gas collector system and the composite cap should be integrated to develop means to minimize intrusive activities during any potential repair jobs and to maintain the cap integrity once the repair job is over.

4.3.4.8 Cost

The estimated capital cost is $8,931,000. The estimated annual operation and maintenance cost is $210,000. The estimated total present worth cost is $11,821,000. This cost includes groundwater monitoring for 30 years, a five-year review, and general maintenance of the cap's integrity. Costs for Alternative 4 are summarized in Table 4-4, and detailed cost calculations and assumptions are presented in Appendix B.

TABLE 4–4
COST FOR ALTERNATIVE 4 – COMPOSITE BARRIER CAP,
ACTIVE GAS COLLECTION & TREATMENT,
GROUNDWATER MONITORING, & INSTITUTIONAL CONTROL
CAPITAL AND O&M COST
Himco Dump Superfund Site
Elkhart, Indiana

I.	CAPITAL COST	
	A. Institutional Control and Groundwater Monitoring	$71,000
	B. Composite Barrier Cap	$6,130,000
	C. Active Gas Collection & Treatment	$271,000
	SUBTOTAL CAPITAL COST	$6,472,000
	Engineering (10%)	$647,200
	Construction Oversight (3%)	$194,160
	Contingencies (25%)	$1,618,000
	TOTAL CAPITAL COST	$8,931,000
II.	ANNUAL O&M COST	
	A. Institutional Control and Groundwater Monitoring	$88,000
	B. Composite Barrier Cap	$64,000
	C. Active Gas Collection & Treatment	$58,000
	TOTAL ANNUAL O&M COST	$210,000
III.	PRESENT WORTH 30–YEAR O&M COST	$2,890,000
IV.	TOTAL PRESENT WORTH COST	$11,821,000

4.4 COMPARISON OF ALTERNATIVES

This section compares the performance of the alternatives against seven evaluation criteria, the nine criteria previously defined with the exception of community and state acceptance, which are not included at this time. Table 4-5 summarizes this comparison for the three alternatives proposed for the Himco site. In addition to the seven evaluation criteria, a cost sensitivity analysis is performed and discussed in this section.

4.4.1 Overall Protection of Human Health and the Environment

Alternative 1, the No Action alternative, does not satisfy the requirement for overall protection of human health and the environment. Human health risk associated with the No Action alternative results from ingestion, inhalation, and direct contact with the landfill waste mass and contaminated soils in the construction debris area. Environmental risk may result from the release of landfill fugitive dust into the air, and the release of leachate into the groundwater aquifer, and outside the landfill boundaries.

Alternatives 2 and 3 provide protection to human health and the environment by containing the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, with a single barrier, solid waste cap and by collecting and treating the landfill gas. With these alternatives, human risk associated with exposure to the wastes in the landfill and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill is theoretically eliminated. Additionally, potential environmental risk associated with release of the leachate into the groundwater or outside the landfill boundaries is reduced.

Alternative 3 provides further protection to the environment with the extraction and off-site treatment and disposal of leachate from the landfill. The potential for release into groundwater or other media outside the landfill boundaries are reduced. It should be noted that the RI data do not indicate that groundwater outside of the landfill boundaries is currently impacted by the site contaminants.

Alternative 4, like Alternatives 2 and 3, provides protection to human health and the environment by containing the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, with a barrier cap. However, the cap in Alternative 4 is a composite barrier, solid waste cap. Alternative 4 provides an added level of protection by minimizing infiltration into the landfill by incorporating a composite barrier cap, thereby minimizing the potential release of leachate into the groundwater and other media outside of the landfill boundaries. As such, although conceptually Alternatives 2, 3, and 4 will provide a significant improvement over the current (No Action) condition, this improvement cannot be theoretically quantified based on risk factors.

TABLE 4-7
COST SUMMARY
Himco Dump Superfund Site
Elkhart, Indiana

Alternatives	Capital Cost	Annual O&M Cost	Total Present Worth Cost*
1. No Action	$0	$0	$0
2. Single Barrier Cap, Gas Collection & Treatment, Groundwater Monitoring, & Institutional Control	$7,539,000	$210,000	$10,429,000
3. Single Barrier Cap, Gas Collection & Treatment, Leachate Collection System, Groundwater Monitoring, & Institutional Control	$13,628,000	$982,000	$27,140,000
4. Composite Barrier Cap, Gas Collection & Treatment, Groundwater Monitoring, & Institutional Control	$8,931,000	$210,000	$11,821,000

* Present worth cost based on interest(i)=6% and 30 years for O&M (see Tables 4-1 through 4-4).

TABLE 4-5

COMPARISON OF FINAL ALTERNATIVES
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
	No Action	Single Barrier Cap w/Gas Collection & Treatment Institutional Controls and Groundwater Monitoring. Five-year Review.	Single Barrier Cap w/Gas Collection & Treatment Leachate Collection & Off-site TSDF Disposal, Institutional Controls and Groundwater Monitoring. Five-year Review.	Composite Barrier Cap w/Gas Collection & Treatment Institutional Controls and Groundwater Monitoring. Five-year Review.
Overall Protection of Human Health and the Environment	No action taken. Not considered to be protective of human health and the environment.	Construction of a single barrier cap reduces the risk of exposure to the landfill contents, and reduces leaching of contaminants to the groundwater. Institutional controls and groundwater monitoring will be required to insure that public health and the environment will continue to be protected.	Construction of a single barrier cap reduces the risk of exposure to the landfill contents, and reduces leachate generation. Incorporation of a leachate system will further reduce leachate in the landfill and reduce potential leaching of contaminants to the groundwater. Institutional controls and groundwater monitoring will still be required to insure that public health and the environment will continue to be protected.	A composite barrier cap will be more reliable than a single barrier cap in terms of preventing direct contact with landfill contents and reducing infiltration. Institutional controls and groundwater monitoring will still be required to insure that public health and the environment will continue to be protected.
Compliance with ARARs	No action taken. Not expected to be in compliance with ARARs.	Expected to be in compliance with ARARs.	Expected to be in compliance with ARARs.	Expected to be in compliance with ARARs.

TABLE 4-5

COMPARISON OF FINAL ALTERNATIVES (Continued)
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Long-term Effectiveness and Permanence				
° Magnitude of existing risk	Risk from direct contact of material will continue to exist.	Reduction of residual risk from direct contact. Lessens future potential for groundwater contamination by reducing infiltration.	Reduction of residual risk from direct contact. Lessens future potential for groundwater contamination by reducing infiltration. Incorporation of the leachate collection system will provide an added level of protection for groundwater relative to Alternative 2.	Reduction of residual risk from direct contact. Lessens future potential for groundwater contamination by reducing infiltration. A composite cap will provide an added level of protection relative to Alternative 2.
° Adequacy and reliability of controls.	Continued degradation of existing cap is likely to continue. Waste will eventually become exposed with the potential of on-site exposure and transport of contaminants off-site.	It is adequate and reliable to protect human health and the environment, however, institutional controls and long-term maintenance are required to maintain cap integrity.	It is adequate and reliable to protect human health and the environment, however, institutional controls and long-term maintenance are required to maintain cap integrity. Incorporation of the leachate collection system will provide an added level of protection relative to Alternative 2.	It is adequate and reliable to protect human health and the environment, however, institutional controls and long-term maintenance are required to maintain cap integrity. A composite cap will provide an added level of protection relative to Alternative 2.

TABLE 4-5

COMPARISON OF FINAL ALTERNATIVES (Continued)
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Reduction of Toxicity, Mobility, and Volume				
° Treatment process used and material treated.	No treatment is included in this alternative.	No treatment of landfill contents. VPAC and possible flarestack for treatment of landfill gas.	No treatment of landfill contents. Leachate will be collected and treated at off-site TSDF. VPAC and possible flarestack for treatment of landfill gas.	No treatment of landfill contents. VPAC and possible flarestack for treatment of landfill gas.
° Amount of hazardous material destroyed or treated.	None.	VOCs in landfill gas.	1.9 million (1) gallons per year of leachate collected and treated. VOCs in landfill gas.	VOCs in landfill gas.
° Expected reduction in toxicity, mobility, and volume.	None	Slight reduction in toxicity and volume. Mobility is expected to be reduced because leachate generation will be reduced.	Slight reduction in toxicity and volume because of leachate and gas collection. Mobility is expected to be reduced because leachate generation will be reduced.	Slight reduction in toxicity and volume. Mobility is expected to be reduced because leachate generation will be reduced.
° Type and quality of treatment residual.	Not applicable.	Spent VPAC material requires recycle or thermal destruction.	Spent VPAC material requires recycle or thermal destruction; collected leachate will be treated off-site.	Spent VPAC material requires recycle or thermal destruction.

TABLE 4-5

COMPARISON OF FINAL ALTERNATIVES (Continued)
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Short-term Effectiveness				
° Protection to the community during remedial action.	No action taken.	Community is protected by controlling dust emmissions.	Community is protected by controlling dust emissions.	Community is protected by controlling dust emisions.
° Protection of workers during remedial action.	No action taken.	Potential risk to workers through inhalation and contact with waste mass during landfill gas collection system installation. Proper dust control and health and safety controls will mitigate risk.	Potential risk to workers through inhalation and contact with waste mass during landfill gas and leachate collection systems installation. Proper dust control and health and safety controls will mitigate risk.	Potential risk to workers through inhalation and contact with waste mass during landfill gas collection system installation. Proper dust control and health and safety controls will mitigate risk.
° Environmental impacts	No action taken.	Potential impact from migration of contaminated runoff during gas collection system installation.	Potential impact from migration of contaminated runoff during gas and leachate collection systems installation.	Potential impact from migration of contaminated runoff during gas collection system installation.
° Time until remedial action objectives are achieved.	No time requirement.	Construction of a single barrier cap will take approximately 12 months. Construction of the gas collection system will take approximately 2 months.	Construction of a single barrier cap will take approximately 12 months. Construction of the gas collection system will take approximately 2 months. Construction of the leachate collection system will take approximately 7 months.	Construction of a composite barrier cap will take approximately 13 months. Construction of the gas collection system will take approximately 2 months.

TABLE 4-5

COMPARISON OF FINAL ALTERNATIVES (Continued)
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Implementability				
° *Technical feasibility*	*No action taken.*			
Ability to construct and operate technology.		Relatively easy to implement. Implementation of this alternative uses conventional equipment and technology.	Relatively easy to implement. Implementation of this alternative uses conventional equipment and technology. Ability to construct and operate leachate collection will be very difficult, if not impossible.	Relatively easy to implement. Implementation of this alternative uses conventional equipment and technology.
Reliability of technology.		Technology is reliable.	Technology for cap and gas collection system is reliable. Reliability of the leachate collection system is questionable.	Technology is reliable.
Ability to monitor effectiveness of remedy.		Monitoring effectiveness will be relatively easy based on visual inspection. Monitoring is possible through routine inspection of the site.	Monitoring effectiveness for the cap and gas collection components will be relatively easy based on visual inspection. Monitoring is possible through routine inspection of the site. Monitoring leachate collection will be very difficult.	Monitoring effectiveness will be relatively easy based on visual inspection. Monitoring is possible through routine inspection of the site.
Ease of undertaking additional action, if any.		Relatively easy to do any additional remediation for a single barrier cap. Some difficulty may arise if the landfill gas collection system requires additional work.	Relatively easy to do any additional remediation for a single barrier cap. Difficulty may arise if the landfill gas collection or leachate collection systems require additional work.	Moderately difficult to do any remediation for a composite barrier cap. Major difficulty may arise if the landfill gas collection system requires additional work.
° Available services and materials.	Not applicable.	Services and material are relatively available.	Services and materials are relatively available.	Services and materials are relatively available.
° Administrative feasibly Ability to coordinate and obtain approval from oher agencies.	No action will be unacceptable because the likely remedy is not protective and will not be in compliance with ARARs.	Possible by contacting Federal and State agencies for applicable requirements.	Possible by contacting Federal and State agencies for applicable requirements.	Possible by contacting Federal and State agencies for applicable requirements.

TABLE 4-5

COMPARISON OF FINAL ALTERNATIVES (Continued)
HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Costs				
° Capital Cost	$0	$7,539,000	$13,628,000	$8,931,000
° Annual O&M Cost	$0	$210,000	$982,000	$210,000

VPAC: Vapor Phase Activated Carbon

(1) Assuming half of the generated leachate will be collected by the leachate collection system.

A/R/HIMCO/AU4

4.4.2 Compliance with ARARs

A summary of ARARs that pertain to each alternative is provided in Table 4-6. Although there are salient variations among the alternatives, all alternatives, except Alternative 1, the No Action alternative, are in compliance with ARARs.

4.4.3 Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion addresses the risk remaining at the Himco site at the conclusion of remedial activities. The primary focus of this evaluation is the extent and effectiveness of controls that may be required to manage the risk posed by treatment residuals and/or untreated waste.

Alternative 1, the No Action alternative, provides no long-term effectiveness and would result in continuation of the elevated risk levels that currently exist at the Himco site.

Alternatives 2 and 3 provide long-term effectiveness and permanence by containing the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, with a single barrier, solid waste cap and by implementing institutional controls to maintain the cap's integrity and restrict groundwater use in the site vicinity.

Alternative 4, like Alternatives 2 and 3, provides long-term effectiveness and permanence by containing the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill, with a composite barrier, solid waste cap and by implementing institutional controls to maintain the cap's integrity, as well as to restrict groundwater use in the site vicinity. For Alternatives 2, 3, and 4, potential environmental risk to the aquifer and other media outside the landfill boundaries are reduced by minimizing leachate generation in the landfill mass. Additionally, groundwater monitoring is included in Alternatives 2, 3, and 4 to ensure that the aquifer would remain unimpacted by the site contaminants.

4.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions which use treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the untreated waste. The preferred treatment processes are those which destroy toxic contaminants, reduce toxic contaminants' total mass, irreversibly reduce contaminant mobility, or reduce total volume of contaminated media.

TABLE 4-6

COMPARISON OF ARARS

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
FEDERAL								
40 CFR 6, Appendix A Protection of Wetlands	Executive Order 11990	Remediation of municipal landfill sites located next to wetland. Areas will have to be implemented in a manner which minimizes the destruction, loss, or degradation of wetlands.	Location	R&A	-	X	X	X
40 CFR 52 Approval and Promulgation of Implementation Plans	52.770 - 52.797	File an Air Pollution Emission Notice (APEN) with the State to include estimation of emission rules for each pollutant expected. Include with filed APEN the following: * Modeled impact analysis of source emissions * Provide a Best Available Control Technology (BACT) review for the source operation. Predict total emissions of volatile organic compounds (VOCs) to demonstrate emissions do not exceed 450 lbs/hr, 3,000 lbs/day, 10 gal/day, or allowable emission levels from similar sources using Reasonably Available Control Technology (RACT).	Action	R&A	-	X	X	X
40 CFR 60	Subpart WWW	Emission guidelines and Compliance schedules for existing landfills.	Action	R&A	-	X	X	X
40 CFR 61 National Emission Standards for Hazardous Air Pollutants	61.01-.06 61.10-.14 61.16-.19	Verify through emission estimates and dispersion modeling that hydrogen sulfide emissions do not create an ambient concentration greater than or equal to 0.10 ppm.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
		Verify that emissions of mercury, vinyl chloride, and benzene do not exceed levels expected from sources in compliance with hazardous air pollution regulations.						
CLEAN WATER ACT (CWA) OF 1977 AS AMENDED [33 U.S.C. 1251]								
40 CFR 122 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)	122.44	Applicable federally approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Action	R&A	-	X	X	X
Water Quality Standards	131							
	122.4	Use of best available technology (BAT) economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.	Action	R&A	-	-	X	-
	122.44(d)(4)	The discharge must conform to applicable water quality requirements when the discharge affects a state other than the certifying state.	Action	R&A	-	-	X	-
	122.44(e)	Discharge limitations must be established for all trade pollutants that are or may be discharged at levels greater than those that can be achieved by technology-based standards.	Action	R&A	-	-	X	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
CLEAN WATER ACT (CWA) OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)								
	122.44(i) 122.21	Discharger must be monitored to ensure compliance. Discharger will monitor: * The mass of each pollutant discharged. * The volume of effluent discharged. * Frequency of discharge and other measurements as appropriate. Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.	Action	R&A	-	-	X	-
	122	Permit application information must be submitted, including a description of activities, listing of environmental permits, etc. Monitor and report results as required by permit (at least annually). Comply with additional permit conditions such as: * Duty to mitigate any adverse effects on any discharge. * Proper operation and maintenance of treatment systems.	Action	NA	-	-	-	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
CLEAN WATER ACT OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)								
40 CFR 125 Criteria and Standards for the National Pollutant Discharge Elimination System	125.1-3 125.100 125.104	Establish criteria and standards for technology-based requirements in permits under Sections 301(b) and 482 of the CWA. Develop and implement the Best Management Practices (BMP) program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters. The BMP program must: * Establish specific procedures for the control of toxic and hazardous pollutant spills. * Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure. * Assure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA.	Action	NA	-	-	X	-
40 CFR 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants	136.1-136.4	Sample preservation procedures, container materials, and maximum allowable holding times are prescribed.	Action	R&A	-	-	X	-
	208(b)	The discharge must be consistent with the requirement of a Water Quality Management Plan approved by EPA under Section 208(b) of the Clean Water Act.	Action	R&A	-	-	X	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
CLEAN WATER ACT OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)								
40 CFR 144 Underground Injection of Wastes and Treated Groundwater	144.12 144.13 144.14	UIC program prohibits: * Injection activities that allow movement of contaminants into underground sources of drinking water (USDW) and result in violations of MCLs or adversely affect health. * Construction of new Class IV wells, and operation and maintenance of existing wells. Wells used to inject contaminated groundwater that has been treated and is being reinjected into the same formation from which it was withdrawn are not prohibited if activity is part of CERCLA or RCRA actions.	Action	NA	-	-	-	-
	144.16	All hazardous waste injection wells must also comply with RCRA requirements.						
40 CFR 403 General Pretreatment Regulations for Existing and New Sources of Pollution								
Discharge to POTW	403.5	Specific prohibitions preclude the discharge of pollutants to POTW that: * Create a fire or explosion hazard in the POTW.	Action	R&A	-	-	X	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
CLEAN WATER ACT (CWA) OF 1977 AS AMENDED [33 U.S.C. 1251] (CONTINUED)		* Are corrosive (pH <3.0). * Obstruct flow resulting in interference. * Are discharged at a flow rate and/or concentration that will result in interference. * Increase the temperature of wastewater entering the treatment plant that would result in interference, but in no case raise the POTW influent temperature above 104°F (40°C).						
CLEAN AIR ACT of 1963, AS AMENDED [42 U.S.C. 7401]	Section 101	Design system to operate odor free. Devise fugitive and odor emission control plan for this section.	Action	R&A	-	X	X	X
50 FR 30784 July 29, 1985	NA	Applicable federal waste quality criteria for the protection of aquatic life must be complied with when environmental factors are being considered.	Action	NA	-	-	X	-
52 FR 3748 February 5, 1987	NA	Proposed standards for control of emissions of volatile organics	Action	R&A	-	X	X	X
20 CFR 1910 Water Protection	All Parts	Rules are administered by IOSHA and do not exceed federal requirements.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901]								
40 CFR 264 Standards for Owners and Operation of Hazardous Waste Treatment, Storage and Disposal (TSD) Facilities								
Disposal and Closure Requirements	264	Area from which materials are excavated may require cleanup to levels established by closure requirements.	Action	Applicable	-	X	X	X
Subpart G	264.18	Post-closure care to ensure that site is maintained and monitored.	Applicable	Applicable	-	X	X	X
	264.71 and 264.72	RCRA permit-by-rule requirements must be complied with for discharges of RCRA hazardous wastes to POTW by truck, rail, or dedicated pipe.	Action	Applicable	-	-	X	-
	264.111	General performance standard requires minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.		R&A	-	X	X	X
		Disposal or decontamination of equipment, structures, and soils.						
		Meet health-based levels of unit.						

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)								
	264.220	Use two liners below the waste, a top liner that prevents waste migration into the liner, and a bottom liner that prevents waste migration through the liner throughout the post-closure period.	Action	Applicable	-	-	-	X
	264.221(c)	Prevent overtopping of surface impoundment.	Action	R&A	-	X	X	X
Subpart X		Standards for miscellaneous units (long-term retrievable storage, thermal treatment other than incinerators, open burning, open detonation, chemical, physical, and biological treatment units using other than tanks, surface impoundments, or land treatment units) require new miscellaneous units to satisfy environmental performance standards by protection of groundwater, surface water, and air quality, and by limiting surface and subsurface migration.	Action	Applicable	-	X	X	X
Subpart D		Treatment of wastes subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste.	Action	Applicable	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)								
	264.228(a)(i) and 264.258	Removal or decontamination of all waste residues, contaminated containment system components (e.g., liners, dikes) contaminated subsoils, and structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	Action	Applicable	-	X	X	X
	264.228(a)and(b) 264.258(b) 264.310(a)and(b) 264.117(c) 264.111	Placement of a cap over hazardous waste (e.g., closing a landfill, or closing a surface impoundment or waste pile as a landfill, or similar action) requires a cover designed and constructed to: * Provide long-term minimization of migration of liquids through the capped area. * Function with minimum maintenance. * Promote drainage and minimum erosion or abrasion of the cover. * Accommodate settling and subsidence so that the cover's integrity is maintained. * Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Eliminate free liquids, stabilize wastes before capping (surface impoundments).	Applicable	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)								
		Restrict post-closure use of property as necessary to prevent damage to the cover. Prevent run-on and runoff from damaging cover. Protect and maintain surveyed benchmarks used to locate waste cells (landfills, waste piles). Disposal or decontamination of equipment, structures, and soils.						
	264.251	Use liner and leachate collection and removal system.	Action	Applicable	-	X	X	X
Surface Water Control	264.251(c)(d) 264.273(c)(d) 264.301(c)(d)	Prevent run-on and control and collect runoff from a 24-hour, 25-year storm (waste piles, land treatment facilities, landfills).	Action	R&A	-	X	X	X
	264.271 264.272 264.273 264.276 264.278 264.281 264.282 264.283	Ensure that hazardous constituents are degraded, transformed, or immobilized within the treatment zone. Maximum depth of treatment zone must be no more than 1.5 meters (5 feet) from the initial soil surface, and more than 1 meter (3 feet) above the seasonal high water table.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)								
		RCRA hazardous wastes are subject to land disposal restrictions. Land disposal restrictions set performance requirements on treatment of the wastes before land disposal. The effective date for final group of RCRA wastes is May 8, 1990. Extensions to the effective dates have been granted for specific RCRA wastes that are contained in soil and/or debris.	Action	Applicable	-	X	X	X
		All noted and characteristic hazardous wastes or soils and debris contaminated by a RCRA hazardous waste and removed from a CERCLA site may not be land disposed until treated as required by Land Ban. If alternative treatment technologies can achieve treatment similar to that required by Land Ban, and if this achievement can be documented, then a variance may not be required.	Applicable	Applicable	-	X	X	X
STATE								
326 INDIANA ADMINISTRATIVE CODE (IAC)								
Ambient Air Quality Standards	1-3	Elkhart County is in non-attainment for ozone, so new sources of prohibited critical pollutants must be monitored. Pollutants of concern for this site are particulate matter and VOCs. If methane flares are employed, they must be equipped with shutoff valves.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
SOLID WASTE DISPOSAL ACT (SWDA) AS AMENDED BY RESOURCE CONSERVATION & RECOVERY ACT (RCRA) OF 1976 [42 U.S.C. 6901] (CONTINUED)								
		Demonstrate that hazardous constituents for each waste can be completely degraded, transformed, or immobilized in the treatment zone.						
		Minimize runoff of hazardous constituents.						
		Maintain run-on/runoff control and management system.						
		Special application conditions if food-chain crops are grown in or on treatment zone.						
		Unsaturated zone monitoring.						
		Special requirements for ignitible or reactive waste.						
		Special requirements for incompatible wastes.						
		Special requirements for RCRA hazardous waste.						
40 CFR 268 Land Disposal Restrictions	268	Placement on or in land outside unit boundary or area of contamination will trigger land disposal requirements and restrictions.	Action	Applicable	-	X	X	X
		Movement of excavated waste fill to a previously uncontaminated, on-site location, and placement in or on land may trigger land disposal restrictions.	Action	Applicable	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
326 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)								
Facility Construction	2	Requires permits for construction of a facility depending upon its potential to emit VOCs. Permit Review Thresholds VOC - 15 lbs/day, 3 lbs/hour, 25 tons/year TSP - 25 lbs/day, 5 lbs/hour, 25 tons/year SO_2 - 20 lbs/day, 10 lbs/hour, 25 tons/year NO_2 - 25 lbs/day, 5 lbs/hour, 25 tons/year CO - 125 lbs/day, 25 lbs/hour, 25 tons/year Lead - 1 ton/year - 5 source types 5 tons/year - other lead source permit levels Facilities with lower emission must be registered.	Action	NA	-	X	X	X
VOC Emissions	8-1-6	This rule establishes limits for VOC emissions from new sources. Best Available Control Technology (BACT) is required for new sources with potential emission of 3 lbs/hour, 15 lbs/day, or 25 tons per year or greater.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
326 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)								
Particulate Matter Emissions	6-4	This rule establishes primary and secondary ambient air quality standards necessary to protect public health and welfare for total suspended particulates (TSP), particulate matter with a nominal diameter less than 10 microns (PM_{10}), lead, ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and carbon monoxide (CO). These standards are shown above.	Action	R&A	-	X	X	X
327 INDIANA ADMINISTRATIVE CODE (IAC)								
Disposal of Wastewater Water Management	2-1	Surface Water Quality Standards are in 327 IAC 2. The rule applies to all waters of the state. "Waters of the state: means such accumulations of water, surface and underground, natural and artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state, but the term does not include any private pond, or any off-stream pond, reservoir or facility built for reduction or control of pollution or cooling of water prior to discharge unless the discharge therefrom causes or threatens to cause water pollution." Although not specifically mentioned, wetlands are included in this definition.	Action	Applicable	-	-	X	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
327 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)								
	2-6	Requires the person responsible for a spill that threatens to enter and damage waters of the state to immediately report the spill to IDEM, immediately notify downstream water users, immediately contain and clean-up the spill, and file reports as required by IDEM.						
	3	327 IAC 3 requires a permit to construct wastewater treatment facility and also for sewer extensions serving a population equivalent of 25 or more, 2,500 gpd or more, or over 300 feet in length, and contains standards for those facilities. Effluent limits must be obtained prior to applying for the construction permit.						
Direct Discharge of Treatment System Effluent	5-2-8 5-2-13 5-2-14 5-2-15	Off-site discharges must obtain a permit pursuant to 327 IAC 5 (NPDES Permit). Effluent limits are obtained from IDEM for either on-site or off-site discharges regardless of the requirement for a permit. Effluent limits are determined on a case-by-case basis. Limits can be requested by a letter containing information including the contaminants and the expected concentrations, volume of treated effluent, name of receiving stream, and proposed POTW and are regulated by the pretreatment sections of 327 IAC 5. Permit may be obtained directly from the POTW if it is delegated. Most large municipal POTWs are delegated. IDEM should be consulted to verify the pretreatment standards of the POTW.	Action	Applicable	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
327 INDIANA ADMINISTRATIVE CODE (IAC) (CONTINUED)								
Public Water Supply	8-1 thru 8-2	Provides public water supply standards for any water which is supplied to the public or is used or available for drinking in any school, resort, camp, hotel, apartment house building, place of employment, or place frequented by the public. Also provides drinking water standards for community water supply serving 25 or more people or 15 service connections. Outlines minimum sampling frequency for groundwater and surface water sources.	Chemical	R&A	-	X	X	X
Public Water Supply Construction	8-3	Requires a permit to construct water main extensions larger than 2,500 feet or 5% increase in customers, public water supplies that serve at least 25 persons or 15 connections, supplies serving restaurants, transient housing, or multiple customers through a plumbing system. Facility must comply with sanitary or health regulations and conform to design criteria in "Recommended Standards for Water Works" established by the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, the American Water Works Association Standards, or acceptable to the Commissioner.	Action	Applicable	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL								
Final Cover of Solid Waste Landfill Disposal Facility	2-4 2-14 2-44 3-53-5(a)	Placement of a cap over a landfill requires a cover designed and constructed to: * Provide long-term minimization of infiltration of liquids through the capped area. * Function with minimum maintenance. * Promote drainage and minimize erosion or abrasion of the cover. * Accommodate settling and subsidence so that the cover's integrity is maintained. * Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	Action	R&A	-	X	X	X
Solid and Hazardous Waste Management	2-21	Cleanup waste that is not hazardous is regulated as Special Waste. Waste must be characterized and certified by the State as special waste, then it can be sent to a sanitary landfill approved to accept special waste. Methods of sampling and analysis are the same as for hazardous waste.	Action	Applicable	-	X	X	X
	3	Indiana has adopted the TCLP for determining characteristic hazardous waste. Indiana also has its own manifest.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL (CONTINUED)								
Security	3-16-5	Sites should be secured in accordance with this rule which: 1. Requires prevention of unknowing and unauthorized entry of persons or livestock if physical contact with the waste, etc., could cause injury or if disturbance of the waste, etc., would cause a violation. 2. The facility must have either: 24-hour surveillance system which continuously monitors and controls entry <u>or</u> an artificial or natural barrier which completely surrounds the active portion <u>and</u> a means to control entry (i.e., a lock) at all times through the gates or other entrances to the active portion. 3. "Danger - Unauthorized Personnel Keep Out" signs are required at each entrance and at other locations sufficient to be seen from any approach, legible from a distance of at least 25 feet.	Action	R&A	-	X	X	X
Contingency Plan	3-18	Existing Hazardous Waste Facility Standards - Contingency Plan and Emergency Procedures, requires that facilities have a contingency plan which minimizes hazards from fire, explosion, or any unplanned sudden or non-sudden release. Emergency coordinator must notify State and local officials specified in the plan.	Action	Applicable	-	-	X	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL (CONTINUED)								
		Include: 1. Name and telephone number of reporter 2. Name and address of facility 3. Time and type of incident 4. Name and quantity of materials involved 5. Extent of injuries 6. Possible hazards to human health/environment outside facility.						
	3-46-2	General performance standard requires minimization of need for further maintenance; control; minimization, or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.	Action	R&A	-	X	X	X
	3-46-5	Disposal or decontamination of equipment, structures and soils must meet both state and federal requirements.	Action	R&A	-	X	X	X
	3-46-8(d)	Restrict post-closure use of property as necessary to prevent damage to cover.	Action	Applicable	-	X	X	X
	3-51-6	Removal or decontamination of all waste residues, contaminated containment system components (e.g., liners, dikes), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	Action	R&A	-	X	X	X

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
329 INDIANA STATE ADMINISTRATIVE CODE (IAC) SOIL AND DEBRIS REMOVAL (CONTINUED)								
	3-53-5	Installation of final cover to provide long-term minimization of infiltration.	Action	Applicable	-	X	X	X
	3-53-5(b)	Prevent run-on and runoff from damaging cover.	Action	Applicable	-	X	X	X
		Protect and maintain surveyed benchmarks used to locate waste cells.						
Surface Water Control	3-53-2(f)(g)(h)	Prevent run-on and control and collect runoff from a 24-hour, 25-year storm during closure and past-closure status.	Action	R&A	-	X	X	X
Excavation	3-40 through 3-54.9	Area from which materials are excavated may require cleanup to levels established by closure requirements.	Action	Applicable	-	X	X	X
INDIANA CODE (IC) DEPARTMENT OF NATURAL RESOURCES								
Construction of Water Treatment Facility	13-2-22	Requires the prior approval of DNR. Project may not 1) restrict the waterway; 2) adversely affect the fish, wildlife, or botanical resources; or 3) be unsafe to life and property.	Action	R&A	-	-	X	-
Construction in a Floodway		Permit is required to 1) place, fill, or erect a permanent structure in; 2) remove water from; or 3) remove material from a navigable waterway.	Action	R&A	-	-	X	-

TABLE 4-6

COMPARISON OF ARARS (CONTINUED)

HIMCO DUMP SUPERFUND SITE
ELKHART, INDIANA
1992

Laws/Regulations	Applicable Rules	Applicability	Classification	Type	Alternative 1	2	3	4
INDIANA CODE (IC) DEPARTMENT OF NATURAL RESOURCES (CONTINUED)								
Extraction Well	13-2-6.1	Extraction wells with 100,000 gpd capacity requires registration with DNR.	Action	NA	-	-	-	-

R&A - Relevant and Applicable
NA - Not Applicable

A/R/HIMCO/AU9

Alternative 1, the No Action alternative, provides no reduction in toxicity, mobility, or volume of potential contaminants in the landfill mass. Alternatives 2 through 4 do not provide any reduction in toxicity or volume except for a slight reduction in VOCs from landfill gas collection. Alternative 3, which incorporates leachate collection systems, provides an added marginal reduction in toxicity and volume relative to Alternatives 2 and 4 by collecting and treating leachate from the landfill. Alternatives 2, 3, and 4 provide reduction in mobility by reducing leachate generation in the landfill.

4.4.5 Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternatives on human health and the environment during construction and implementation phases. The short-term effectiveness period extends until the remedial response objectives are met. All of the alternatives, with the exception of Alternative 1, the No Action alternative, include measures to minimize the short-term impacts during construction, such as dust control, safe work practices, etc.

Issues related to worker protection are similar for Alternatives 2, 3, and 4. There are risks associated with workers' exposure to the landfill content during installation of leachate wells and gas wells. However, these risks can be controlled by following the appropriate health and safety requirements.

4.4.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative, and the availability of various services and materials required for its implementation.

Technically, all the alternatives are implementable and can be readily constructed with technology and materials presently available. Design requirements for Alternatives 2 and 3, which include a single barrier, solid waste cap, are somewhat easier than for Alternative 4, which includes a geomembrane liner in the composite barrier, solid waste cap. Operation of Alternatives 2 and 4 is somewhat easier than for Alternative 3, which includes a leachate collection and storage system, and requires periodic disposal of leachate at an off-site TSDF.

4.4.7 Cost

This section describes present worth costs for Alternatives 2 through 4 followed by a cost sensitivity analysis for these alternatives.

4.4.7.1 Present Worth Cost

Alternatives are evaluated for cost in terms of capital costs, annual O&M costs, and present worth costs. The present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year (namely, present worth cost). This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with a remedial alternative over its planned life. Present worth costs were formulated for Alternatives 1 through 4. Table 4-7 summarizes the capital, O&M, and present worth costs for these alternatives.

4.4.7.2 Cost Sensitivity Analysis

Cost sensitivity is the influence of a specific cost element on the results of the overall cost estimate. If an element can be varied over a wide range of values without significantly affecting the overall estimate, the estimate is said to be insensitive to that particular element. In contrast, if a small change in the estimate of one element will substantially modify the overall estimate, the ranking is highly sensitive to that element.

In conducting the present worth analysis, a number of assumptions were made. The cost sensitivity analysis presented in Table 4-8 and the following paragraphs evaluates the impact of varying specific assumptions associated with the design, implementation, operation, and unit cost rate, on the estimated present worth costs. The following factors are evaluated in the cost sensitivity analysis:

1. Unit cost rates for the components of the single or composite barrier cap

2. Alternative design associated with the additional soil (buffer) layer in the cap construction

3. Frequency of the carbon filter change for the landfill gas

4. Volume of landfill leachate to be collected, treated, and discharged

Following is an evaluation of cost sensitivity for each of the above factors.

1. Unit cost rates for the components of the single or composite barrier cap.

TABLE 4-8
SUMMARY OF COST SENSITIVITY ANALYSIS
Himco Dump Superfund Site
Elkhart, Indiana

Alternative	Baseline Calculated PW Cost	50% Gas Volume Decrease PW Cost	50% Gas Volume Increase PW Cost	50% Lch Volume Decrease PW Cost	50% Lch Volume Increase PW Cost	Cap Design Alternative Decrease PW Cost	Cap Unit Cost Increase PW Cost
1. No Action	$0	$0	$0	$0	$0	$0	$0
2. Single Barrier Cap, Gas Collection & Treatment, Groundwater Monitoring, & Institutional Control	$10,429,000	$10,291,000	$10,552,000	$10,429,000	$10,429,000	$9,460,000	$15,226,000
3. Single Barrier Cap, Gas Collection & Treatment, Leachate Collection & Treatment, Groundwater Monitoring, & Institutional Control	$27,140,000	$27,003,000	$27,264,000	$22,613,000	$31,667,000	$26,171,000	$31,936,000
4. Composite Barrier Cap, Gas Collection & Treatment, Groundwater Monitoring, & Institutional Control	$11,821,000	$11,683,000	$11,944,000	$11,821,000	$11,821,000	$10,853,000	$16,618,000

Lch = Leachate
PW = Present Worth

Lower Limit and Upper Limit PW Cost for combined components.

Alternative	Baseline Calculated PW Cost	Lower Limit PW Cost	Upper Limit PW Cost
1. No Action	$0	$0	$0
2. Single Barrier Cap, Gas Collection & Treatment, Groundwater Monitoring, & Institutional Control	$10,429,000	$9,322,000	$15,349,000
3. Single Barrier Cap, Gas Collection & Treatment, Leachate Collection & Treatment, Groundwater Monitoring, & Institutional Control	$27,140,000	$21,507,000	$36,587,000
4. Composite Barrier Cap, Gas Collection & Treatment, Groundwater Monitoring, & Institutional Control	$11,821,000	$10,715,000	$16,741,000

In costing the alternatives, SEC Donohue found significant differences among the quotes obtained from local vendors and the Means Heavy Construction Cost Data, 1992, (Means) unit rate costs for supply and placement (and compaction, if necessary) of the topsoil, clay cap layer, and additional soil (buffer) layer used in the single or composite barrier cap. The FS used the quotes from local vendors for the baseline cost estimate. The Means unit rate costs were up to 100 percent higher than the quotes provided by the local vendors. For the sensitivity analysis, the Means unit cost rates were used as the upper limit for the cost sensitivity analysis. Because all alternatives, except the No Action alternative, incorporate a single or a composite barrier cap, these alternatives are sensitive to the variations associated with the unit cost rates. Using the Means unit, the topsoil supply and placement for the same hauling distance changed from $9.29 to $20.02 per cubic yard; clay cap supply and placement changed from $7.65 to $11.48 per cubic yard; and the additional soil (buffer) layer changed from $7.57 to $11.25 per cubic yard (Tables B2-2, B2-3, BU2-2, and BU2-3 in Appendix B).

2. Alternative design associated with the buffer layer in the cap construction.

According to the IDEM requirement, a 4 percent slope is required for the cap to ensure sufficient drainage on the landfill cap and to control infiltration into the landfill. The current landfill cover soil has a slope of approximately 1 percent. The cover soil consists of 0.5 to more than 1-foot of topsoil underlain by 0.5 to 9 feet of calcium sulfate layer. As a baseline cap design, it was assumed that an additional layer of soil (buffer) will be added to the current cover soil to create the required 4 percent slope on the cap. This yields an approximate cost of $1,440,600. However, as an alternative to this design, it is possible to create the required 4 percent slope by performing cut and fill on the topsoil and the calcium sulfate layers without impacting the waste mass in the landfill. This alternative may be considered in the actual design phase after further investigating the thickness of the topsoil and the calcium sulfate layer. For the sensitivity analysis, this design alternative has been considered as the lower limit cost. Because all alternatives, except the No Action alternative, incorporate a single or a composite barrier cap, these alternatives are sensitive to the variations associated with the alternative design for the additional soil (buffer) layer. Based on this alternative design, the cost for the buffer layer installation changed from $1,440,571 to $737,888 (Tables B2-2, B2-3, BL2-2,and BL2-3 in Appendix B).

3. Frequency of the carbon filter change for the landfill gas.

The frequency of the carbon absorber change for VOC treatment of the landfill gas was estimated based on past experience in similar projects. However, because of the potential major differences among landfills, the required rate of the carbon filter change may be significantly less or more than the frequency used in the baseline cost calculation. Based on the above discussions, 150 percent and 50 percent of the baseline frequency were used as the upper and lower limit frequencies in the sensitivity analysis. Because all alternatives, except the No Action alternative, incorporate a gas collection system, these alternatives are sensitive to the variations in the frequency of the carbon absorption change for the landfill gas. Using the above percentages, the annual O&M costs changed from $58,000 (baseline cost) to $67,000 for the upper limit and $48,000 for the lower limit.

4. Volume of landfill leachate to be collected, treated, and discharged.

Collection of leachate was considered as an element of Alternative 3. An estimate of the leachate generation rate has been made using the hydrogeologic evaluation of landfill performance (HELP) model. According to this estimate, the total leachate volume is estimated at 3.7 million gallons per year for Alternative 3 (single barrier cap). Furthermore, due to the existence of the hydraulic connection between the landfill and groundwater, it was assumed that half the total leachate volume (1.9 million gallons per year) will be collected and treated. This volume has been used in the baseline cost estimate for volume of the leachate to be collected, treated, and discharged.

However, there are many uncertainties associated with the above numerical calculations. (See Technical Memorandum in Appendix A.) In addition, there is uncertainty as to how much of the generated leachate can be captured by the proposed leachate collection system. Based on these uncertainties, 150 percent, and 50 percent of the baseline leachate volumes were used as the upper and lower limit volumes in the sensitivity analysis. Because leachate collection is included only in Alternative 3, this alternative alone is sensitive to the change in the volume of leachate collected and treated. Using the above percentages, the annual O&M costs changed from $772,000 (baseline cost) to $1,101,000 for the upper limit and $443,000 for the lower limit over the 30-year treatment period.

4.5 UNCERTAINTY ANALYSIS

A significant challenge in conducting the RI/FS is to account effectively for the inherent uncertainties associated with the remediation of uncontrolled hazardous waste sites. These uncertainties can be numerous, ranging from potential unknowns regarding site hydrogeology and the extent of contamination, to the performance of treatment and engineering controls. The objective of the RI/FS process is not the removal of all uncertainties but rather the gathering of information sufficient to support an informed risk management decision to determine which remedy appears most appropriate for a given site.

The remedial alternatives presented in the preceding sections consist of response actions to contain the landfill waste mass, and the contaminated surface soil in the construction debris area and in an area immediately south of the landfill. The proposed alternatives address the sources and pathways of risk to human health and the environment. Throughout the RI/FS process, a number of assumptions have been made about the environmental and health risks, volume of contamination requiring containment, and cost for remediating the site. The discussion that follows identifies a number of uncertainties specific to the Himco site and briefly reviews the implications of the assumptions.

4.5.1 Extent of PAH Contamination in the Construction Debris Area

The lateral extent of the PAH-contaminated soil in the construction debris area was estimated based on a limited soil sampling in this area. Additional soil sampling is warranted, which may be conducted as a part of the pre-design investigation, to determine the exact lateral extent of the soil contamination in the area. Because containment, rather than removal and treatment, has been proposed as the potential remedy for this contamination, the focus of the pre-design investigation should be to determine the lateral extent, rather than the vertical extent of this contamination.

4.5.2 Leachate Generation Rate in the Landfill and Impact to Groundwater

The RI data indicate that the site groundwater has not been impacted by leachate from the landfill. There is an uncertainty as to whether the RI data were sufficient to generalize the RI conclusion or there were releases which remained undetected in the RI sampling.

Although it is not possible to remove the above uncertainty, the proposed alternatives for this site include components to protect the groundwater. Capping, which has been incorporated in all alternatives except the No Action alternative, will minimize any potential impact to groundwater by controlling infiltration into the landfill. In addition, groundwater monitoring, which has been included in Alternatives 2 through 4, will provide an added level of protection by providing warnings if releases to the groundwater occur. If the results show unacceptable contaminant levels in the site groundwater (see Appendix A for the proposed levels of contaminants of concern which trigger a groundwater study), a groundwater study will be conducted to evaluate the potential risks to human health and the environment and to take the appropriate measures to mitigate these risks.

4.5.3 Risk Calculation

The major sources of uncertainties in the risk calculations for the Himco site include the following:

- The hypothetical future use scenario evaluated in the risk assessment for the Himco site may have led to an overestimate.
- Determination of the appropriate exposure factors to be used in calculating intakes can be highly uncertain. Attempts were made to use standardized exposure factors when possible, and to derive conservative, but not unrealistic, values where standard factors were not available. Therefore, exposure estimates contribute to an overestimate of risk.
- Toxicity values that were used were derived using conservative procedures, particularly for cancer risk; thus, they are likely to overestimate true risks.
- Additive effect of risk and hazard index may overstate risk.

4.5.4 Technology Performance

There is uncertainty is associated with technology performances such as a leachate collection system and gas collection system to effectively remove leachate and gas from the landfill.

4.6 ADDITIONAL DATA NEEDS

Additional groundwater data are required to monitor the groundwater condition and to evaluate whether groundwater would remain unimpacted by the site contaminants. As a comment element in all of the proposed alternatives, a groundwater monitoring program has been proposed to provide data relative to the future groundwater condition at this site. The proposed groundwater monitoring program will be developed during the pre-design/design phase of the project.

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